MINUTES OF PROCEEDINGS

OF THE

ROYAL SOCIETY OF CANADA

1956

PROCÈS-VERBAUX

DE LA

SOCIÉTÉ ROYALE DU CANADA

1956

OTTAWA
ROYAL SOCIETY OF CANADA

INFORMATION FOR SUBSCRIBERS

Cheques covering subscriptions to the publications of the Royal Society of Canada should be made payable to the Royal Society of Canada, National Research Building, Sussex Drive, Ottawa, Canada. Bound Volume XLVI, 1952, and all subsequent volumes, $14.00; Proceedings, $2.00; Sections I and II combined, $3.00; Sections III, IV, V, $2.00 each.

The Proceedings and Transactions of the Royal Society of Canada appear annually.

Some of the past publications of the Royal Society of Canada from 1882 to 1951 may be obtained: Bound volumes $7.00, Proceedings and Sections, $1.00 each.

The Royal Society of Canada issues a series of pamphlets which are available individually. These may be obtained from the University of Toronto Press.

Application forms and Regulations for the Royal Society of Canada Scholarships will be sent upon request.

ABONNEMENTS

Prière d'établir les chèques, relatifs à l'abonnement aux publications de la Société royale du Canada, à l'ordre de la Société royale du Canada, Immeuble du Conseil national de recherches, avenue Sussex, Ottawa (Canada). Le volume XLVI (relié) de 1952 et tout volume subséquent, $14; les Procès-verbaux, $2; les Mémoires réunis des Sections I et II, $3; les Mémoires des Sections III, IV et V, $2 chaque volume.

Les Procès-verbaux et les Mémoires de la Société royale du Canada paraissent chaque année.

On peut se procurer les publications antérieures de la Société royale du Canada, de 1882 à 1951, à raison de $7 le volume relié; les Procès-verbaux et les Mémoires des Sections, $1 chaque volume.

La Société royale du Canada publie une série de brochures, qu'on peut se procurer séparément, en s'adressant à l'"University of Toronto Press".

Demander, le cas échéant, les modèles de demande et le règlement des bourses de la Société royale du Canada.

MINUTES OF PROCEEDINGS

OF THE

ROYAL SOCIETY OF CANADA

1956

PROCÈS-VERBAUX

DE LA

SOCIÉTÉ ROYALE DU CANADA

1956

OTTAWA
ROYAL SOCIETY OF CANADA

TABLE OF CONTENTS

THE ROYAL SOCIETY OF CANADA

Founder: HIS GRACE THE DUKE OF ARGYLL, K.T., etc.
(When Governor-General of Canada in 1882)

OFFICERS FOR 1956–1957

HONORARY PATRON
HIS EXCELLENCY THE GOVERNOR-GENERAL

PRESIDENT: W. A. MACKINTOSH, C.M.G., M.A., PH.D., LL.D., D.C.L.
VICE-PRESIDENT: T. W. M. CAMERON, M.A., PH.D., D.SC., M.R.C.V.S.
HONORARY SECRETARY: PIERRE DAVIAULT
ASSOCIATE HONORARY SECRETARY: C. P. STACEY, O.B.E., A.M., PH.D.
HONORARY TREASURER: N. E. GIBBONS, M.A., PH.D.
HONORARY EDITOR: G. W. BROWN, M.A., PH.D., LL.D.
HONORARY LIBRARIAN: W. KAYE LAMB, M.A., PH.D., LL.D.

Officers of Sections

SECTION I. *Humanités et sciences sociales*

PRÉSIDENT . . . . . JEAN-MARIE GAUVREAU, D.SC.POL.
VICE-PRÉSIDENT . . . . . HARRY BERNARD, B.A., L.ès L., D.ès L.
SECRÉTAIRE . . . . . ADRIEN PLOUFFE, M.D., D.PH.

SECTION II. *Humanities and Social Sciences*

PRESIDENT . . . . . W. KAYE LAMB, M.A., PH.D., LL.D.
VICE-PRESIDENT . . . . . F. H. UNDERHILL, M.A.
SECRETARY . . . . . S. D. CLARK, M.A. PH.D.

SECTION III. *Mathematical, Chemical, and Physical Sciences*

PRESIDENT . . . . . H. S. M. COXETER, PH.D., F.R.S.
VICE-PRESIDENT . . . . . LÉO MARION, M.B.E., M.SC., PH.D.
SECRETARY . . . . . A. D. MISENER, M.A., PH.D.

SECTION IV. *Geological and Allied Sciences*

PRESIDENT . . . . . H. C. GUNNING, B.A.SC., S.M., PH.D.
VICE-PRESIDENT . . . . . H. C. RICKABY, M.A.
SECRETARY . . . . . H. S. BOSTOCK, M.SC., PH.D.

SECTION V. *Biological Sciences*

PRESIDENT . . . . . W. H. COOK, O.B.E., M.SC., PH.D., LL.D.
VICE-PRESIDENT . . . . . W. R. CAMPBELL, M.A., M.D.
SECRETARY . . . . . N. H. GRACE, M.B.E., M.A., PH.D.

Past Presidents

JEAN BRUCHÉSI, B.A., LL.L., D.SC.POL., D.ès L.
E. W. R. STEACIE, O.B.E., M.SC., PH.D., D.SC., LL.D., F.R.S.
G. S. HUME, O.B.E., PH.D.

Additional Members of Council

MAURICE LEBEL, M.A., L.ès L., PH.D. B. S. KEIRSTEAD, B.A., LL.D.
W. H. WATSON, M.A., PH.D. J. E. HAWLEY, M.A., PH.D.
GEORGES MAHEUX, M.A., I.F., M.SC.AG., D.SC.

COMMITTEES APPOINTED FOR THE YEAR 1956–57

EXECUTIVE COMMITTEE

Chairman: W. A. MACKINTOSH
Members: T. W. M. CAMERON, PIERRE DAVIAULT, N. E. GIBBONS, C. P. STACEY, W. KAYE LAMB, LÉO MARION, H. S. BOSTOCK

EDITORIAL COMMITTEE

Chairman: The Honorary Editor, G. W. BROWN
Members: The Honorary Secretary, PIERRE DAVIAULT; the Honorary Treasurer, N. E. GIBBONS; DONATIEN FRÉMONT, LÉON LORRAIN, ADRIEN PLOUFFE (*Chairman*), Section I; S. D. CLARK, B. S. KEIRSTEAD (*Chairman*), HUGH MACLENNAN, W. L. MORTON, Section II; D. A. KEYS (*Chairman*), G. DE B. ROBINSON, T. THORVALDSON, Section III; H. C. GUNNING (*Chairman*) and Fellows of Section in Vancouver, H. S. BOSTOCK, Section IV; E. HORNE CRAIGIE (*Chairman*), A. FRAPPIER, H. B. SIFTON, Section V

GENERAL NOMINATING COMMITTEE

Chairman: The President, W. A. MACKINTOSH
Members: JEAN-MARIE GAUVREAU, ADRIEN PLOUFFE, Section I; F. A. KNOX, F. H. SOWARD, Section II; H. S. M. COXETER, LÉO MARION, Section III; J. E. GILL, J. E. HAWLEY, Section IV; A. G. HUNTSMAN, W. P. THOMPSON, Section V

MEDAL COMMITTEES

Chauveau Medal—*Convener:* JEAN-MARIE GAUVREAU
Members: PIERRE DAVIAULT, ROBERT ELIE, LÉON LORTIE, HARRY BERNARD

Flavelle Medal—*Convener:* J. A. DAUPHINEE
Members: M. W. BANNAN, L. DAVIAULT, G. H. ETTINGER, J. L. HART, R. F. SHANER

Henry Marshall Tory Medal—*Convener:* OTTO MAASS
Members: J. S. FOSTER, G. HERZBERG, E. W. R. STEACIE, T. THORVALDSON

Lorne Pierce Medal—*Convener:* W. A. MACKINTOSH
Members: HARRY BERNARD, ROBERT ELIE, ANTOINE ROY, Section I; W. KAYE LAMB, W. C. D. PACEY, F. H. UNDERHILL, Section II

Tyrrell Medal—*Convener:* W. A. MACKINTOSH
Members: HARRY BERNARD, JEAN BRUCHÉSI, ANTOINE ROY, Section I; W. KAYE LAMB, J. A. CORRY, F. H. UNDERHILL, Section II

Willet G. Miller Medal—*Convener:* L. S. RUSSELL
Members: A. R. BYERS, F. F. OSBORNE, J. S. STEVENSON, A. E. WILSON

ADVISORY COMMITTEES: NOMINATIONS

SECTION I—*Chairman:* JEAN-MARIE GAUVREAU
Members: HARRY BERNARD, JEAN-CHARLES BONENFANT, PIERRE DAVIAULT, LÉON LORRAIN, GÉRARD MORISSET, ADRIEN PLOUFFE

SECTION II—*Chairman:* F. H. UNDERHILL
Members: W. KAYE LAMB, S. D. CLARK, V. C. FOWKE, T. GOUDGE, MALCOLM ROSS

SECTION III—*Chairman:* D. J. LEROY
Members: A. MCKELLAR, D. C. ROSE, and Officers of the Section

SECTION IV—*Chairman:* L. G. BERRY
Members: H. S. BOSTOCK, G. M. BROWNELL,* D. R. DERRY, G. V. DOUGLAS,* V. J. OKULITCH, J. S. STEVENSON.* (*Elected for two years)

SECTION V—*Chairman:* F. R. HAYES
Members: W. R. CAMPBELL, I. MCT. COWAN, P. DANSEREAU, K. FISHER, G. KROTKOV, N. H. GRACE

SELECTION COMMITTEES: RESEARCH SCHOLARSHIPS

SECTION I—*Chairman:* MAURICE LEBEL
Members: JEAN BRUCHÉSI, R. P. GEORGES HENRI LEVESQUE, R. P. LOUIS MARIE RÉGIS, JEAN VALLERAND

SECTION II—*Chairman:* F. E. L. PRIESTLEY
Members: W. KAYE LAMB, F. H. UNDERHILL

SECTION III—*Chairman:* C. S. BEALS
Members: B. W. CURRIE, P. GIGUÈRE, R. L. JEFFERY

SECTION IV—*Chairman:* E. S. MOORE
Members: H. J. FRASER, I. W. JONES

SECTION V—*Chairman:* D. L. THOMSON
Members: BLYTHE EAGLES, R. POMERLEAU, R. J. ROSSITER

RESEARCH SCHOLARSHIPS BOARD

Chairman: The President, W. A. MACKINTOSH
Members: The Honorary Secretary, PIERRE DEVIAULT; the Honorary Treasurer, N. E. GIBBONS, and the Chairman of the Research Scholarship Selection Committees

CANADIAN GOVERNMENT OVERSEAS AWARDS COMMITTEE

Chairman: W. KAYE LAMB
Members: The Executive Committee: W. A. MACKINTOSH, T. W. M. CAMERON, PIERRE DAVIAULT, N. E. GIBBONS, C. P. STACEY, LÉO MARION, H. S. BOSTOCK

COMMITTEE ON PLANS

Chairman: T. W. M. CAMERON
Members: LÉON LORTIE, W. KAYE LAMB, LÉO MARION, J. T. WILSON, W. H. COOK, and G. W. BROWN, Honorary Editor

COMMITTEE ON ORGANIZATION

Chairman: W. A. MACKINTOSH
Members: T. W. M. CAMERON, PIERRE DAVIAULT, N. E. GIBBONS, C. P. STACEY, H. S. BOSTOCK

PUBLICATIONS COMMITTEE

Chairman: G. W. Brown
Members: Pierre Daviault, W. Kaye Lamb, Léo Marion, F. J. Alcock, T. W. M. Cameron, C. P. Stacey, and N. E. Gibbons

PROGRAMME COMMITTEE

Section I—*Chairman:* Léon Lortie
Members: Jean-Charles Falardeau, Adrien Plouffe

Section II—*Chairman:* B. S. Keirstead
Members: S. D. Clark, Hugh MacLennan, W. L. Morton

Section III—*Chairman:* A. D. Misener
Members: J. S. Marshall, G. de B. Robinson, W. H. Watson, Léo Marion, H. S. M. Coxeter

Section IV—*Chairman:* J. T. Wilson
Members: J. E. Gill, J. E. Hawley

Section V—*Chairman:* C. A. Mitchell
Members: N. E. Gibbons, J. W. Groves (power to add)

CANADIAN COMMITTEE ON OCEANOGRAPHY

Chairman: A. G. Huntsman
Members: C. S. Beals, W. A. Clemens, G. S. Field, F. K. Hare (McGill University, Montreal), H. B. Hachey, J. B. Tulley (Pacific Biological Station, Nanaimo, B.C.), J. T. Wilson, W. Templeman, Andrew Thomson, and M. J. Dunbar

REPRESENTATIVES ON THE CANADIAN COMMITTEE OF THE INTERNATIONAL ASTRONOMICAL UNION

B. W. Currie, Helen S. Hogg and Andrew Thomson

REPRESENTATIVES ON THE EDITORIAL BOARD OF THE CANADIAN JOURNALS OF RESEARCH

H. E. Duckworth, T. Thorvaldson, Section III; D. L. Bailey and T. W. M. Cameron, Section V

THE ROYAL SOCIETY OF CANADA

HONORARY FELLOWS

His Excellency the Right Honourable VINCENT MASSEY, C.H.
General the Hon. A. G. L. MCNAUGHTON, P.C., C.H., C.B., C.M.G., D.S.O., M.Sc., D.C.L., LL.D.
The Rt. Hon. L. S. ST. LAURENT, P.C., Q.C., LL.D.

FELLOWS

(The date given is the date of election)

FELLOWS UNATTACHED

1935—ARCHIBALD, E. S., C.B.E., B.S.A., LL.D., D.Sc., 185 Stanley Ave., Ottawa, Ont.
1942—BARTON, G. S. H., C.M.G., B.S.A., D.Sc.A., C.A.M., 243 McLeod St., Ottawa, Ont. (retired)
1943—FINN, D. B., C.M.G., B.Sc., M.Sc., Ph.D., F.C.I.C., Director, Fisheries Division, F.A.O., Viale delle Terme di Caracalla, Rome, Italy.
1942—KLINCK, LEONARD S., B.S.A., M.S.A., D.Sc., LL.D., 2627 Marine Drive, West Vancouver, B.C.
1941—MACKENZIE, C. J., C.M.G., M.C., B.E., M.C.E., D.Sc., LL.D., F.R.S., President, Atomic Energy Control Board, Ottawa, Ont.
1937—MORGAN, A. E., M.A., LL.D., Toynbee Hall, Commercial Street, London, E.1, England.
1952—VANDRY, Mgr F., C.M.G., P.A., D.Th., Ph.D., Chev. Légion d'honneur, Séminaire de Québec, Québec (P.Q.).

SECTION I—HUMANITÉS ET SCIENCES SOCIALES

Membres à la retraite

1935—CHARBONNEAU, JEAN, 350, avenue de l'Epée, Outremont, Montréal (P.Q.)
1935—HÉBERT, MAURICE, D. ès L., 89, avenue du Parc, Québec (P.Q.)

Membres actifs

1956—AUDET, LOUIS-PHILIPPE, B.Péd., L.ès Sc. D.Péd., surintendant des cours de culture populaire au Service de l'aide à la jeunesse, 88, Grande Allée, Québec (P.Q.)
1924—BEAUCHESNE, ARTHUR, C.M.G., M.A., D.ès L., LL.D., C.R., 417 est, avenue Laurier, Ottawa (Ont.)
1943—BERNARD, HARRY, B.A., L.ès L., D.ès L., 665, rue Sainte-Anne, Saint-Hyacinthe (P.Q.)
1954—BONENFANT, JEAN-CHARLES, B.A., LL.L., Bibliothécaire de la Législature provinciale de Québec, Québec (P.Q.)
1954—BROUILLETTE, BENOÎT, B.A., L.S.C., D.U.P., D.ès L., Université de Montréal, Montréal (P.Q.)
1940—BRUCHÉSI, JEAN, LL.L., D.Sc.Pol., D.ès L., D.Litt., Chevalier de la Légion d'honneur, Sous secrétaire de la province de Québec, 273, avenue Laurier, Québec (P.Q.). (Ex-président.)
1947—CARBOTTE, Mme GABRIELLE ROY, 305, Grande Allée, App. 708, Québec (P.Q.)
1948—CHABOT, Mlle CÉCILE, 2435, avenue Maplewood, Montréal (P.Q.).
1916—CHARTIER, Mgr EMILE, M.A., D.Phil., D.ès L., LL.D., L.ès L., Ph.D., 27, rue Gordon, App. 3, Sherbrooke (P.Q.)
1946—CHAUVIN, JEAN, Croix de Guerre, 975, rue de Bullion, Montréal (P.Q.)

1939—DAVIAULT, PIERRE, Directeur des services de traduction de l'Etat, 531, rue Besserer, Ottawa (Ont.)
1945—DE KONINCK, CHARLES, Ph.D., Université Laval, Québec (P.Q.)
1919—DELÂGE, l'Hon. CYRILLE-F., C.M.G., Commandeur de l'Ordre de Pie IX, Ch. Légion d'honneur, LL.D., D.Litt., D.Paed., Off. d'Inst. Publique, 3, rue Sainte-Julie, Québec (P.Q.)
1953—DÉSY, Son Ex. JEAN, LL.D., LL.L., Dr.Jur., C.R., Ambassadeur du Canada à Paris, Paris, France.
1955—D'ESCHAMBAULT, l'abbé ANTOINE, B.A., D.Th., D.ès L., Genthon (Man.)
1955—ELIE, ROBERT, B.A., directeur des services de presse et d'information (français) à Radio-Canada, Montréal (P.Q.)
1954—FALARDEAU, JEAN-C., M.A., L.Ph., Université Laval, Québec (P.Q.)
1956—FARIBAULT, MARCEL, LL.L., LL.D., D.C.L., Président et directeur général du Trust Général du Canada, 640, avenue Dunlop, Montréal (P.Q.)
1942—FRÉMONT, DONATIEN, B.A., Ch.Légion d'honneur, 1628, avenue Leclair, Verdun, Montréal (P.Q.)
1948—GARNEAU, RENÉ, B.A., L.ès L., Ch.Légion d'honneur, Premier secrétaire, Ambassade du Canada, Paris, France.
1942—GAUVREAU, JEAN-MARIE, D.Sc.Pol., Directeur de l'école du meuble de la province de Québec, 1097, rue Berri, Montréal (P.Q.)
1939—GOUIN, l'Hon. Léon Mercier, B.A., LL.L., LL.D., C.R., D.Sc.Pol., Off. d'inst. publique, Ch. Légion d'honneur, 511 Place d'Armes, Montréal (P.Q.)
1956—LAMONTAGNE, MAURICE, L.Sc.Soc., M.A., Conseiller économique du Conseil Privé, Hôtel du gouvernement, Ottawa (Ont.)
1926—LANCTÔT, GUSTAVE, LL.M., D.ès L., LL.D., D.Sc.Pol., C.R., Ch. Légion d'honneur, 154, avenue Daly, Ottawa (Ont.) (Ex-président)
1953—LAURENCE, JEAN-MARIE, B.A., 5353, avenue Monkland, Montréal (P.Q.)
1947—LEBEL, MAURICE, M.A., L.ès L., Ph.D., Université Laval, Québec (P.Q.)
1956—LEFEBVRE, JEAN-JACQUES, B.L., Archiviste, Palais de Justice, Montréal (P.Q.)
1944—L'HEUREUX, EUGÈNE, B.A., LL.L., 806, Madeleine-de-Verchères, Québec (P.Q.)
1949—LEMELIN, ROGER, journaliste, 1446, rue du Buisson, Québec (P.Q.)
1949—LÉVESQUE, le R. P. GEORGES-HENRI, S.Th.L., LL.D., Montmorency House, 2490 Mount Royal Ave., Québec (P.Q.)
1947—LORRAIN, LÉON, D.Sc.Com., Banque Canadienne Nationale, Montréal (P.Q.)
1953—LORTIE, Léon, B.A., L.ès Sc., D.ès Sc., Université de Montréal, Montréal (P.Q.)
1941—MAHEUX, l'abbé ARTHUR, O.B.E., M.A., L.ès L., D.Th., Université Laval, Québec (P.Q.)
1947—MARCHAND, CLÉMENT, B.A., 1563, rue Royale, Trois Rivières (P.Q.)
1934—MARION, SÉRAPHIN, M.A., D.U.P., D.ès L., 131, avenue Sunnyside, Ottawa (Ont.)
1931—MAURAULT, Mgr OLIVIER, C.M.G., P.D., LL.D., p.SS., D.ès L., D.C.L., 116, rue Notre-Dame ouest, Montréal (P.Q.) (Ex-président)
1943—MELANÇON, CLAUDE, Directeur adjoint du service des relations publiques, Chemin de fer national du Canada, Montréal (P.Q.)
1916—MORIN, VICTOR, B.A., LL.D., O.I.P., Ch. Grand'Croix de l'Ordre du Saint-Sépulcre de Jérusalem, 34, ouest rue Saint-Jacques, Montréal (P.Q.) (Ex-président)
1943—MORISSET, GÉRARD, B.A., LL.L., Musée de la province, Québec (P.Q.)
1946—NADEAU, JEAN-MARIE, B.A., L. ès L., L.Sc.Soc., LL.D., 132, ouest rue Saint-Jacques, Montréal (P.Q.)
1941—OLLIVIER, MAURICE, B.A., LL.D., C.R., Greffier en loi, Chambre des Communes, Ottawa (Ont.)
1948—PLOUFFE, ADRIEN, M.D., D.Ph., A.A.A.S., 4315, rue Saint-Hubert, Montréal (P.Q.)
1953—RÉGIS, le R. P. LOUIS-MARIE, O.P., L.S.Th., Ph.D., Doyen de la faculté de philosophie, Université de Montréal, Montréal (P.Q.)
1951—ROBIDOUX, LOUIS-PHILIPPE, B.A., Rédacteur en chef, "La Tribune", Sherbrooke (P.Q.)

1948—Roy, Antoine, D.ès L., Archiviste de la Province de Québec, Québec (P.Q.)
1926—Saint-Pierre, Arthur, D.Sc.Pol., 2095, avenue Grey, Montréal (P.Q.)
1940—Simard, le R. P. Georges, O.M.I., D.Ph., D.Th., Université d'Ottawa, Ottawa (Ont.)
1951—Sylvestre, Guy, M.A., L.Ph., 355, rue Wilbrod, Ottawa (Ont.)
1944—Tessier, Mgr Albert, P.D., S.T.D., D.Th., Ph.D., Séminaire des Trois Rivières, Trois Rivières (P.Q.)
1954—Vallerand, Jean, B.A., L.ès L., Conservatoire de musique de la province de Québec, 1700, rue Saint-Denis, Montréal (P.Q.)

Section II.—HUMANITIES AND SOCIAL SCIENCES

Retired Members

1936—Alexander, W. H., A.M., Ph.D., LL.D., 1341 Josephine St., Berkeley, California, U.S.A.
1935—Bovey, Wilfrid, O.B.E., LL.D., Litt.D., LL.D., 1374 Sherbrooke St. West, Montreal, P.Q.
1923—Coats, R. H., B.A., LL.D., 572 Manor Road, Rockcliffe, Ont.
1917—Currelly, C. T., M.A., LL.D., R.R. 3, Port Hope, Ont.
1925—DeWitt, N. W., Ph.D., 143 Eleventh St., Lincoln, Ill., U.S.A.
1948—Evans, D. O., M.A., D.Phil., D.Litt., Morlais, Beaumaris, Anglesey, G.B.
1927—Fay, C. R., M.A., D.Sc., Cambridge, England.
1940—Flenley, Ralph, M.A., D.Litt., Holywell Hotel, Parkgate, Cheshire, England.
1922—Fox, W. S., M.A., Ph.D., D.Litt., LL.D., O.S.J., 270 Regent St., London, Ont.
1932—Fyfe, Sir William H., M.A., LL.D., D.Litt., 10 St. Germans Place, London, England.
1938—Gordon, R. K., M.A., Ph.D., Box 2150, R.R. 1, Penticton, B.C.
1942—Humphrey, George, M.A., Ph.D., Oxford University, Oxford, England.
1929—Jenness, Diamond, M.A., Litt.D., 108 Broadway Ave., Ottawa, Ont.
1935—Kennedy, W. P. M., M.A., LL.B., Litt.D., LL.D., Docteur en Droit, 77 Spadina Rd., Toronto, Ont.
1934—Larson, Thorleif, M.A., 1235 West 27th Ave., Vancouver, B.C.
1946—Lodge, R.C., M.A., 775 Dade Boulevard, Miami Beach 39, Florida, U.S.A.
1943—Logan, H. A., A.B., Ph.D., Stouffville, Ont.
1921—MacIver, R. M., M.A., D.Phil., D.Sc., LL.D., Litt.D., L.H.D., Heyhoe Woods, Palisades, N.Y.C., U.S.A.
1936—McNeill, W. E., M.A., Ph.D., D.C.L., LL.D., 32 Queen's Crescent, Kingston, Ont.
1946—Meek, T. J., B.D., D.D., Ph.D., University College, Toronto, Ont.
1942—Michell, Humfrey, M.A., Box 611, Lennoxville, P.Q.
1926—Pierce, Lorne, LL.D., Litt.D., "South Ridge" 309, 49 Glen Elm Ave., Toronto 7, Ont.
1941—Thompson, H. A., M.A., Ph.D., LL.D., Institute for Advanced Study, Princeton, N.J., U.S.A.
1942—Todd, O. H., Ph.D., University of British Columbia, Vancouver, B.C.
1928—Wallace, W. S., M.A., LL.D., 12 Admiral Rd., Toronto, Ont.
1942—White, Rt. Rev. W. C., B.D., D.D., Fonthill, Ont.

Active Members

1948—Alexander, Henry, M.A., Professor of English, Queen's University, Kingston, Ont.
1937—Anderson, F. H., M.A., Ph.D., Head, Department of Philosophy, University of Toronto, Toronto, Ont.
1939—Angus, H. F., M.A., B.C.L., LL.D., Head, Department of Economics, Political Science and Sociology, and Dean, Faculty of Graduate Studies, University of British Columbia, Vancouver, B.C. (Ex-President.)

1951—BAILEY, A. G., M.A., Ph.D., Dean of Arts and Professor of History, University of New Brunswick, Fredericton, N.B.

1954—BIRNEY, A. E., M.A., Ph.D., Professor of English, University of British Columbia, Vancouver, B.C.

1943—BLADEN, V. W., M.A., Professor and Chairman, Department of Political Economy, University of Toronto, Toronto, Ont.

1938—BRADY, ALEXANDER, M.A., Ph.D., Professor of Political Science, University of Toronto, Toronto, Ont.

1950—BRITNELL, G. E., M.A., Ph.D., Head, Department of Economics and Political Science, University of Saskatchewan, Saskatoon, Sask.

1945—BROWN, G. W., M.A., Ph.D., LL.D., Professor of History, University of Toronto, and Honorary Editor, University of Toronto Press, Toronto, Ont.

1943—CLARK, A. F. B., M.A., Ph.D., Officier d'Académie, 40 Tarlton Rd., Toronto, Ont.

1953—CLARK, S. D., M.A., Ph.D., Professor of Sociology, University of Toronto, Toronto, Ont.

1950—COLLIN, W. E., L.ès L., M.A., R.R. 1, Byron, Ont.

1944—CORRY, J. A., LL.B., B.C.L., LL.M., LL.D., Hardy Professor of Political Science and Vice-President, Queen's University, Kingston, Ont.

1946—CREIGHTON, D. G., M.A., LL.D., Professor of History, University of Toronto, Toronto, Ont.

1943—CURTIS, C. A., Ph.D., Queen's University, Kingston, Ont.

1950—DANIELLS, ROY, M.A., Ph.D., Chairman, Department of English, University of British Columbia, Vancouver, B.C.

1941—DAWSON, C. A., Ph.D., Victoria, P.E.I.

1935—DAWSON, R. MACG., A.M., M.Sc., D.Sc., LL.D., Official Biographer of late Hon. W. L. Mackenzie King, Ottawa, Ont.

1948—DENOMY, ALEX J., M.A., Ph.D., Professor of Comparative Literature, Pontifical Institute of Mediaeval Studies, 59 Queen's Park Crescent, Toronto, Ont.

1935—DORLAND, A. G., M.A., Ph.D., Professor of History and Head of Department, University of Western Ontario, London, Ont.

1954—DUTHIE, G. I., M.A., Ph.D., D.Litt., Regius (Chalmers) Professor of English Literature, University of Aberdeen, Aberdeen, Scotland.

1947—ELLIOTT, G. A., M.A., Professor of Economics, University of Toronto, Toronto, Ont.

1947—FAIRLEY, BARKER, M.A., Ph.D., Litt.D., Professor of German, University College, Toronto, Ont.

1954—FERGUSON, G. V., B.A., LL.D., Editor, Montreal Star, Montreal, P.Q.

1944—FIELDHOUSE, H. N., M.A., Dean of McGill College, McGill University, Montreal, P.Q.

1954—FOWKE, V. C., M.A., Ph.D., Professor of Economics, University of Saskatchewan, Saskatoon, Sask.

1951—FRYE, H. N., M.A., Professor of English, Victoria College, Toronto, Ont.

1956—GETTY, R. J., M.A., Professor and Head, Department of Classics, University College, Toronto, Ont.

1956—GILMOUR, G. P., B.Th., B.D., M.A., D.D., D.C.L., LL.D., President and Vice-Chancellor, McMaster University, Hamilton, Ont.

1956—GILSON, E. H., D.ès L., Professor, Pontifical Institute of Mediaeval Studies, University of Toronto, Toronto, Ont.

1955—GOUDGE, T. A., M.A., Ph.D., Professor of Philosophy, University of Toronto, Toronto, Ont.

1951—GRUBE, G. M. A., M.A., Professor of Classics, Trinity College, University of Toronto, Toronto, Ont.

1928—HARVEY, D. C., M.A., LL.D., Archivist, Province of Nova Scotia, Halifax, N.S.

1956—HAWTHORN, H. B., M.Sc., Ph.D., Professor of Anthropology, Chairman, Department of Anthropology, Sociology and Criminology, University of British Columbia, Vancouver, B.C.

1948—James, F. Cyril, M.A., Ph.D., LL.D., D.C.L., D.Sc., Ch. de la Lég. d'Honneur, Principal and Vice-Chancellor, McGill University, Montreal, P.Q.

1944—Keirstead, B. S., B.A., LL.D., Professor of Political Economy, University of Toronto, Toronto, Ont.

1936—Kirkconnell, Watson, M.A., Ph.D., D.Litt., D.P.Ec., LL.D., F.R.A.I., President, Acadia University, Wolfville, N.S.

1944—Knox, F. A., B.A., Professor of Economics and Head, Department of Political and Economic Science, Queen's University, Kingston, Ont.

1949—Lamb, W. Kaye, M.A., Ph.D., LL.D., Dominion Archivist, Public Archives of Canada, Ottawa, Ont.

1929—Landon, Fred, M.A., LL.D., D.Litt., 846 Hellmuth Ave., London, Ont.

1953—Leechman, J. D., M.A., Ph.D., Director of Western Canadiana, Glenbow Foundation, Michael Bldg., Calgary, Alta.

1949—Long, M. H., M.A., Professor Emeritus of History, University of Alberta, Edmonton, Alta.

1954—Longley, R. S., M.A., Ph.D., LL.D., Dean of Arts and Science and Alumni, and Professor of History, Acadia University, Wolfville, N.S.

1941—Lower, A. R. M., M.A., Ph.D., LL.D., James Douglas Professor of Canadian History, Queen's University, Kingston, Ont.

1937—MacGibbon, D. A., M.A., Ph.D., LL.D., 33 Norfolk St. North, Hamilton, Ont.

1954—MacGregor, D. C., M.A., Professor, Department of Political Economy, University of Toronto, Toronto, Ont.

1942—MacKay, R. A., B.A., Ph.D., LL.D., Permanent Representative (Canada) to United Nations, 620 Fifth Ave., New York, N.Y., U.S.A.

1943—MacKenzie, N. A. M., C.M.G., M.M., Q.C., LL.B., LL.M., LL.D., D.C.L., D.Sc. President, University of British Columbia, Vancouver, B.C.

1953—MacLennan, Hugh, M.A., Ph.D., D.Litt., Associate Professor of English (part-time) McGill University, Montreal, P.Q.

1933—Mackintosh, W. A., C.M.G., M.A., Ph.D., Vice-Chancellor and Principal, Queen's University, Kingston, Ont.

1949—Marshall, Herbert, O.B.E., B.A., Dominion Statistician, Dominion Bureau of Statistics, Ottawa, Ont.

1920—Martin, Chester, M.A., LL.D., Professor Emeritus of History, University of Toronto, Toronto, Ont.

1953—Masters, D. C., M.A., D.Phil., Professor of History, Bishop's University, Lennoxville, P.Q.

1941—McIlwraith, T. F., M.A., Professor and Head, Department of Anthropology, University of Toronto, Toronto, Ont.

1956—Morton, W. L., B.Litt., M.A., Professor and Chairman, Department of History, University of Manitoba, Winnipeg, Man.

1946—Muckle, J. T., M.A., D.Litt., Professor of Latin and Latin Palaeography, Pontifical Institute of Mediaeval Studies, 59 Queen's Park Crescent, Toronto, Ont.

1937—New, C. W., B.D., B.S.L., Ph.D., Professor Emeritus of History, McMaster University, Hamilton, Ont.

1955—Pacey, W. C. D., Ph.D., Professor and Head, Department of English, University of New Brunswick, Fredericton, N.B.

1950—Pegis, A. C., M.A., Ph.D., LL.D., Professor of the History of Philosophy, Pontifical Institute of Mediaeval Studies and School of Graduate Studies, University of Toronto, Toronto, Ont.

1942—Phelan, G. B., S.T.B., M.A., Ph.D., LL.D., Professor of Philosophy, St. Michael's College, University of Toronto, Toronto, Ont.

1949—Phelps, A. L., B.A., 400 Byron St. South, Whitby, Ont.

1930—Pratt, E. J., C.M.G., M.A., Ph.D., Litt.D., LL.D., D.C.L., 47 Glencairn Ave., Toronto, Ont.

1953—Priestley, F. E. L., M.A., Ph.D., Professor of English, University College, Toronto

1953—RADDALL, T. H., LL.D., author, 44 Park St., Liverpool, N.S.
1936—RAYMOND, W. O., M.A., L.Th., Ph.D., D.C.L., 50 Park Ave., Lennoxville, P.Q.
1953—ROSE, W. J., M.A., Ph.D., LL.D., Lecturer, University of British Columbia, Vancouver, B.C.
1955—ROSS, M. M., M.A., Ph.D., Professor of English and Editor, Queen's Quarterly, Queen's University, Kingston, Ont.
1956—ROUILLARD, C. D., A.M., Ph.D., Officier d'Académie, Professor, Department of French, University College, Toronto, Ont.
1937—SAGE, W. N., M.A., Ph.D., Professor Emeritus and Special Lecturer, University of British Columbia, Vancouver, B.C.
1954—SALMON, E. T., M.A., Ph.D., Messecar Professor of History and Head of Department, McMaster University, Hamilton, Ont.
1942—SALTER, F. M., A.M., D.Litt., F.R.S.L., Professor of English, University of Alberta, Edmonton, Alta.
1947—SCOTT, F. R., B.Litt., B.C.L., Professor of Law, McGill University, Montreal, P.Q.
1955—SCOTT, R. B. Y., M.A., Ph.D., B.D., D.D., Murray Dodge Hall, Princeton, N.J., U.S.A.
1946—SHAW, J. E., Ph.D., 75 Walmer Rd., Toronto, Ont.
1955—SIMPSON, G. W., M.A., Ph.D., Professor of History and Head, Department of History, University of Saskatchewan, Saskatoon, Sask.
1948—SISSONS, C. B., LL.D., Newcastle, Ont.
1950—SMITH, S. E., Q.C., M.A., LL.B., LL.D., D.C.L., President, University of Toronto, Toronto, Ont.
1947—SOWARD, F. H., B.Litt., Head of Department of History, University of British Columbia, Vancouver, B.C.
1951—STACEY, CHARLES P., O.B.E., A.M., Ph.D., Director, Historical Section, Army Headquarters, Ottawa, Ont.
1933—STANLEY, CARLETON, M.A., LL.D., Litt.D., Uxbridge, Ont.
1953—STANLEY, GEORGE F. G., M.A., B.Litt., D.Phil., Head, Department of History, Royal Military College of Canada, Kingston, Ont.
1942—STEVENSON, G. H., M.D., Research Professor in Psychiatry, University of British Columbia, Vancouver, B.C.
1930—SURVEYER, HON. E. FABRE, Q.C., LL.L., B.C.L., LL.D., Officier d'Académie, Chevalier de la Légion d'Honneur, Chevalier de la Couronne d'Italie, Judge of the Superior Court for Province of Quebec, Montreal, P.Q.
1949—TALMAN, J. J., M.A., Ph.D., Chief Librarian, University of Western Ontario, London, Ont.
1951—TAYLOR, K. W., C.B.E., M.A., LL.D., Deputy Minister of Finance, Government of Canada, Ottawa, Ont.
1942—THOMSON, J. S., M.A., D.D., LL.D., Dean, Faculty of Divinity, and Professor of Philosophy of Religion, McGill University, Montreal, P.Q.
1951—TIMLIN, MABEL F., Ph.D., Professor of Economics, University of Saskatchewan, Saskatoon, Sask.
1949—UNDERHILL, F. H., M.A., Curator, Laurier House, Ottawa, Ont.
1955—WILKINSON, B., M.A., Ph.D., Professor of Mediaeval History, University of Toronto, Toronto, Ont.
1950—WILSON, G. E., M.A., Ph.D., LL.D., Dean of Arts and Science, Dalhousie University, Halifax, N.S.
1942—WOODHOUSE, A. S. P., A.M., D.Litt., Professor and Head, Department of English, University College, and the School of Graduate Studies, University of Toronto, Toronto, Ont.

SECTION III.—MATHEMATICAL, CHEMICAL, AND PHYSICAL SCIENCES

Retired Members

1934—ALTY, THOMAS, D.Sc., Ph.D., D.C.L., LL.D., Rhodes University, Grahamstown, South Africa.
1929—ARDAGH, E. G. R., B.A.Sc., 219 Old Yonge St., Willowdale, Ont.
1915—BAIN, JAMES W., M.B.E., B.A.Sc., 30 Burton Rd., Toronto, Ont.
1916—BRONSON, H. L., Ph.D., LL.D., 10 Studley Ave., Halifax, N.S.
1915—CLARK, A. L., B.Sc., Ph.D., Queen's University, Kingston, Ont.
1928—DINES, LLOYD L., M.A., Ph.D., LL.D., 131 North 14th St., Quincy, Ill., U.S.A.
1924—FERGUSON, JOHN B., B.A., 106 Stuart Ave., Willowdale, Ont.
1922—GRAY, J. A., D.Sc., F.R.S., 26 Wellington St., Kingston, Ont.
1922—HUGHES, A. LL., M.Sc., D.Sc., Washington University, St. Louis, Mo., U.S.A.
1930—LANG, R. J., M.A., Ph.D., 146 Douro St., Peterborough, Ont.
1940—MCCLUNG, ROBERT K., M.A., D.Sc., 88 Chestnut St., Winnipeg, Man.
1938—MCRAE, JOHN A., M.A., Ph.D., D.Sc., Queen's University, Kingston, Ont.
1926—ROBERTSON, J. K., M.A., 57A Primrose Gardens, Hampstead, London, England. (Ex-President.)
1917—SATTERLY, JOHN, M.A., D.Sc., A.R.C.Sc., University of Toronto, Toronto, Ont.
1934—STEVENSON, ARTHUR F. C., M.A., Ph.D., Wayne University, Detroit, Mich., U.S.A.
1932—SYNGE, JOHN L., M.A., Sc.D., F.R.S., Institute for Advanced Studies, Dublin, Ireland.
1924—WHITBY, GEORGE S., D.Sc., Ph.D., LL.D., A.R.C.Sc., University of Akron, Akron, Ohio, U.S.A.
1910—WILSON, HAROLD A., M.A., M.Sc., D.Sc., 1515 Milford St., Houston 6, Texas, U.S.A.
1923—YOUNG, R. K., Ph.D., 13 Church St., South, Richmond Hill, Ont.

Active Members

1953—ADAMS, G. A., M.Sc., Ph.D., Senior Research Officer, Division of Applied Biology, National Research Council, Ottawa, Ont.
1909—ALLEN, FRANK, M.A., Ph.D., LL.D., 6A Linda Lee Apts., Hargrave St., Winnipeg, Man.
1947—ARCHIBALD, WILLIAM J., M.A., Ph.D., Professor, Physics Department, Dalhousie University, Halifax, N.S.
1948—BABBITT, J. D., B.A.(Oxon), D.Phil., Canadian Scientific Liaison Officer, Canadian Embassy, Washington, D.C., U.S.A.
1956—BAER, ERICH, Ph.D., Professor and Head of Sub-department of Synthetic Chemistry, Banting and Best Department of Medical Research, University of Toronto, Toronto, Ont.
1938—BARNES, WILLIAM H., M.Sc., Ph.D., Senior Research Officer, Physics Division, National Research Council, Ottawa, Ont.
1933—BEALS, C. S., M.A., D.I.C., Ph.D., D.Sc., F.R.S., Dominion Astronomer, Dominion Observatory, Ottawa, Ont.
1925—BEATTY, SAMUEL, M.A., Ph.D., Dean Emeritus and Chancellor, University of Toronto, Toronto, Ont.
1955—BELL, R. E., M.A., Ph.D., Radiation Laboratory, McGill University, Montreal, P.Q.
1953—BERNSTEIN, H. J., M.A., Ph.D., Senior Research Chemist, Division of Pure Chemistry, National Research Council, Ottawa, Ont.
1945—BRAUER, RICHARD D., M.A., Ph.D., Professor of Mathematics, Harvard University, Cambridge, Mass., U.S.A.
1939—BROCKLESBY, H. N., M.Sc., Ph.D., F.R.I.C., 501 Seaside Ave., Terminal Island, California, U.S.A.

1940—CAMPBELL, ALAN N., M.Sc., Ph.D., D.Sc., Chairman, Chemistry Department, University of Manitoba, Winnipeg, Man.

1941—CAMPBELL, W. BOYD, B.Sc., Ph.D., 4217 Kensington Ave., Montreal, P.Q.

1951—CARMICHAEL, HUGH, B.Sc., Ph.D., Atomic Energy of Canada, Ltd., Chalk River, Ont.

1923—CHANT, C. A., M.A., Ph.D., LL.D., Director Emeritus, David Dunlap Observatory, and Professor of Astrophysics Emeritus, University of Toronto, Richmond Hill, Ont.

1928—CLARK, ROBERT H., M.A., Ph.D., Emeritus Professor, Department of Chemistry, University of British Columbia, Vancouver, B.C.

1941—COXETER, H. S. M., Ph.D., F.R.S., Professor, Department of Mathematics, University of Toronto, Toronto, Ont.

1939—CRAWFORD, M. F., M.A., Ph.D., University of Toronto, Toronto, Ont.

1947—CURRIE, B. W., M.Sc., Ph.D., Professor and Head of Physics Department, University of Saskatchewan, Saskatoon, Sask.

1950—DARWENT, B. DE B., B.Sc., Ph.D., Department of Chemistry, Catholic University of America, Washington 17, D.C., U.S.A.

1948—DAVIES, F. T., B.Sc., M.Sc., Superintendent, Telecommunications Establishment, Defence Research Board, Ottawa, Ont.

1944—DEARLE, R. C., M.B.E., M.A., Ph.D., University of Western Ontario, London, Ont.

1938—DELURY, RALPH E., M.A., Ph.D., Manilla, Ont.

1951—DEMERS, PIERRE, L.Sc., M.Sc., D.Sc., Agrégé de l'Université de France, Professor, Department of Physics, University of Montreal, Montreal, P.Q.

1955—DERRY, DOUGLAS, Ph.D., Professor, Department of Mathematics, University of British Columbia, Vancouver, B.C.

1954—DOUGLAS, A. E., M.A., Ph.D., Research Physicist, Division of Physics, National Research Council, Ottawa, Ont.

1954—DUCKWORTH, H. E., B.Sc., Ph.D., Professor of Physics, Hamilton College, McMaster University, Hamilton, Ont.

1949—ELLIOTT, L. G., M.Sc., Ph.D., Research Director, Division of Physics, Atomic Energy of Canada, Ltd., Chalk River, Ont.

1944—FIELD, GEORGE S., M.B.E., M.Sc., D.Sc., Deputy Director General, Defence Research Board, Ottawa, Ont.

1950—FLOOD, E. A., O.B.E., B.Sc., Sc.M., A.M., Ph.D., Division of Pure Chemistry, National Research Council, Ottawa, Ont.

1929—FOSTER, J. S., D.Sc., Ph.D., F.R.S., McGill University, Montreal, P.Q.

1940—GAGNON, PAUL E., B.A.Sc., D.ès-Sc., D.I.C., Ph.D., Director of the Graduate School and of the Department of Chemistry, Laval University, Quebec, P.Q.

1954—GAUDRY, ROGER, B.Sc.A., D.Sc., Ayerst, McKenna & Harrison, Montreal, P.Q.

1954—GIGUÈRE, PAUL A., B.Sc., Ph.D., Professor of Physical Chemistry, Laval University, Quebec, P.Q.

1925—GILCHRIST, LACHLAN, M.A., Ph.D., Professor Emeritus of Geophysics, University of Toronto, Toronto, Ont.

1952—GISHLER, P. E., M.Sc., Ph.D., Canadian Chemical Co., Box 99, Edmonton, Alta.

1937—GORDON, A. R., O.B.E., M.A., Ph.D., Professor and Head of Department of Chemistry and Dean of School of Graduate Studies, University of Toronto, Toronto, Ont.

1950—HACHEY, H. B., M.B.E., E.D., M.Sc., LL.D., Chief Oceanographer, Fisheries Research Board, St. Andrews, N.B.

1953—HALPERIN, I., M.A., Ph.D., Professor of Mathematics, Queen's University, Kingston, Ont.

1954—HASLAM, R. N. H., M.A., Ph.D., Professor of Physics, University of Saskatchewan, Saskatoon, Sask.

1932—HATCHER, W. H., M.Sc., Ph.D., Professor of Chemistry, McGill University, Montreal, P.Q.

1944—HENDERSON, JOHN T., M.B.E., M.Sc., Ph.D., Applied Physics Branch, Division of Physics, National Research Council, Ottawa, Ont.

1949—HENDERSON, W. J., M.A., Ph.D., Atomic Energy of Canada, Ltd., Chalk River, Ont.

1939—HERZBERG, GERHARD, M.A., Dr.Ing., LL.D., F.R.S., Director, Division of Physics, National Research Council, Ottawa, Ont.

1945—HEWSON, E. WENDELL, M.A., D.I.C., Ph.D., Professor of Meteorology, Department of Civil Engineering, University of Michigan, Ann Arbor, Michigan, U.S.A.

1936—HODGSON, ERNEST A., M.A., Ph.D., Box 235, Port Perry, Ont.

1946—HOGG, HELEN S., A.M., Ph.D., Assistant Professor and Research Associate, David Dunlap Observatory, University of Toronto, Richmond Hill, Ont.

1949—HOLMES, R. H. L., M.Sc., A.M., Ph.D., Research Chemist, Lincoln Laboratories, Inc., Decatur, Ill., U.S.A.

1946—HOWLETT, L. E., M.A., Ph.D., Director, Applied Physics Branch, Division of Physics, National Research Council, Ottawa, Ont.

1954—HURST, D. G., M.Sc., Ph.D., Principal Research Officer, Atomic Energy of Canada, Ltd., Chalk River, Ont.

1947—INFELD, LEOPOLD, Ph.D., Professor, Warsaw University, Warsaw, Poland.

1943—JAMES, R. D., M.A., Ph.D., Professor and Head, Department of Mathematics, University of British Columbia, Vancouver, B.C.

1937—JEFFERY, R. L., M.A., Ph.D., Queen's University, Kingston, Ont.

1951—JOHNS, H. E., M.A., Ph.D., Professor of Physics, University of Saskatchewan, Saskatoon, Sask.

1948—JONES, R. N., M.Sc., Ph.D., D.Sc., Senior Research Chemist, Division of Pure Chemistry, National Research Council, Ottawa, Ont.

1952—KATZ, LEON, M.Sc., Ph.D., Professor of Physics, University of Saskatchewan, Saskatoon, Sask.

1926—KEYS, DAVID A., M.A., Ph.D., D.Sc., Scientific Adviser to the President, Atomic Energy of Canada, Ltd., Chalk River, Ont.

1954—KINSEY, B. B., Ph.D., c/o A.E.R.E., Harwell, Didcot, Berkshire, England.

1953—KULKA, M., M.Sc., Ph.D., Research Chemist, Dominion Rubber Company, Guelph, Ont.

1943—LANGSTROTH, G. O., Ph.D., Chief Superintendent, Suffield Experimental Station, Ralston, Alta.

1941—LAURENCE, G. C., M.B.E., M.Sc., Ph.D., Atomic Energy of Canada, Ltd., Chalk River, Ont.

1947—LEROY, D. J., M.A., Ph.D., Professor of Chemistry, University of Toronto, Toronto, Ont.

1952—LEWIS, W. B., C.B.E., M.A., Ph.D., F.R.S., Vice-President, Research and Development, Atomic Energy of Canada, Ltd., Chalk River, Ont.

1956—LOSSING, F. P., M.A., Ph.D., Senior Research Officer, National Research Council, Ottawa, Ont.

1922—MAASS, OTTO, C.B.E., D.Sc., Ph.D., LL.D., F.R.S., Division of Pure Chemistry, National Research Council, Ottawa, Ont.

1953—MACPHAIL, M. S., M.A., D.Phil., Professor, Carleton College, Ottawa, Ont.

1935—MANSKE, R. H. F., M.Sc., Ph.D., D.Sc., Director of Research, Dominion Rubber Company, Guelph, Ont.

1942—MARION, LÉO, M.B.E., M.Sc., Ph.D., Director, Division of Pure Chemistry, National Research Council, Ottawa, Ont.

1953—MARSHALL, J. S., M.A., Ph.D., Professor of Physics, McGill University, Montreal, P.Q.

1951—MASON, S. G., B.Eng., Ph.D., Head, Physical Chemistry Division, Pulp and Paper Research Institute of Canada, Montreal, P.Q.

1954—MCCALLUM, K. J., M.Sc., Ph.D., Professor of Chemistry, University of Saskatchewan, Saskatoon, Sask.

1948—MCINTOSH, R. L., M.Sc., Ph.D., Professor of Chemistry, University of Toronto, Toronto, Ont.

1942—McKellar, Andrew, M.B.E., M.A., Ph.D., Astrophysicist, Dominion Astrophysical Observatory, Victoria, B.C.

1952—McKinley, D. W. R., O.B.E., M.A., Ph.D., Assistant Director, Radio and Electrical Engineering Division, National Research Council, Ottawa, Ont.

1936—McLay, A. B., M.A., Ph.D., Professor of Physics and Chairman of Department, Hamilton College, McMaster University, Hamilton, Ont.

1943—Middleton, W. E. K., M.Sc., Physicist, National Research Council, Ottawa, Ont.

1942—Miller, Andrew H., M.A., 326 Fairmont Ave., Ottawa, Ont.

1949—Misener, A. D., M.A., Ph.D., Professor of Physics and Head of Department, University of Western Ontario, London, Ont.

1955—Morrison, J. A., M.Sc., Ph.D., Senior Research Officer, Division of Pure Chemistry, National Research Council, Ottawa, Ont.

1947—Munro, L. A., M.A., Ph.D., Professor of Chemistry, Queen's University, Kingston, Ont.

1942—Niven, C. D., B.Sc., Ph.D., Physicist, National Research Council, Ottawa, Ont.

1950—Ouellet, Cyrias, B.Sc., D.Sc., Professor of Physical Chemistry, Laval University, Quebec, P.Q.

1940—Pall, Gordon, M.A., Ph.D., Professor of Mathematics, Illinois Institute of Technology, Chicago, Illinois, U.S.A.

1933—Parkin, J. H., C.B.E., B.A.Sc., M.E., Director, Division of Mechanical Engineering, National Research Council, Ottawa, Ont.

1956—Patterson, G. N., M.A., Ph.D., Director, Institute of Aerophysics; Chairman, Department of Aeronautical Engineering and Aerophysics, University of Toronto, Toronto, Ont.

1931—Pearce, J. A., M.A., Ph.D., Dominion Astrophysical Observatory, Victoria, B.C. (Ex-President.)

1940—Petrie, R. M., M.B.E., A.M., Ph.D., Dominion Astrophysicist, Dominion Astrophysical Observatory, Royal Oak, B.C.

1950—Petrie, William, A.M., Ph.D., Superintendent, Operational Research Group, Defence Research Board, Ottawa, Ont.

1955—Pickup, Eric, B.Sc., Ph.D., Research Officer, Physics Division, National Research Council, Ottawa, Ont.

1942—Pidgeon, L. M., M.B.E., M.Sc., Ph.D., Head, Department of Metallurgical Engineering, University of Toronto, Toronto, Ont.

1955—Pringle, Robert, B.Sc., Ph.D., Chairman, Department of Physics, University of Manitoba, Winnipeg, Man.

1949—Puddington, I. E., M.Sc., Ph.D., Director, Division of Applied Chemistry, National Research Council, Ottawa, Ont.

1949—Purves, C. B., B.Sc., Ph.D., D.Sc., E. B. Eddy Professor of Industrial and Cellulose Chemistry, McGill University, Montreal, P.Q.

1954—Risi, Joseph, L.Sc., D.Sc., Professor of Organic Chemistry, Laval University, Quebec, P.Q.

1944—Robinson, Gilbert de B., M.B.E., Ph.D., Professor, Department of Mathematics, University of Toronto, Toronto, Ont.

1956—Robson, J. M., M.A., Branch Head, Nuclear Physics I, Atomic Energy of Canada Limited, Chalk River, Ont.

1936—Rose, D. C., O.B.E., M.Sc., Ph.D., Principal Research Officer, Division of Physics, National Research Council, Ottawa, Ont.

1947—Sandin, R. B., M.Sc., Ph.D., University of Alberta, Edmonton, Alta.

1941—Sargent, B. W., M.B.E., M.A., Ph.D., R. Samuel McLaughlin Research Professor of Physics and Head of Department, Queen's University, Kingston, Ont.

1952—Scherk, Peter, Ph.D., Associate Professor, Department of Mathematics, University of Saskatchewan, Saskatoon, Sask.

1951—Schneider, W. G., M.Sc., Ph.D., Senior Research Chemist, National Research Council, Ottawa, Ont.

1923—Shaw, A. Norman, M.A., D.Sc., LL.D., 2125 Sunset Rd., Montreal 16, P.Q.
1935—Shrum, G. M., O.B.E., M.A., Ph.D., Professor and Head, Department of Physics, University of British Columbia, Vancouver, B.C.
1940—Smith, H. Grayson, M.B.E., M.A., Ph.D., Head, Department of Physics, University of Alberta, Edmonton, Alta.
1943—Spinks, J. W. T., M.B.E., B.Sc., Ph.D., Head, Department of Chemistry, and Dean of Graduate Studies, University of Saskatchewan, Saskatoon, Sask.
1934—Steacie, E. W. R., O.B.E., M.Sc., Ph.D., D.Sc., LL.D., F.R.S., President, National Research Council, Ottawa, Ont. (Ex-President.)
1943—Thode, H. G., M.B.E., M.Sc., Ph.D., F.R.S., D.Sc., Principal, Hamilton College, and Director of Research, McMaster University, Hamilton, Ont.
1935—Thomson, Andrew, O.B.E., M.A., 36 Russell Hill Rd., Toronto, Ont.
1926—Thorvaldson, T., Order of the Falcon (Iceland), M.A., Ph.D., D.Sc., LL.D., Co-Ordinator of Research, Saskatchewan Research Council, University of Saskatchewan, Saskatoon, Sask.
1948—Volkoff, G. M., M.B.E., M.A., Ph.D., D.Sc., Professor of Physics, University of British Columbia, Vancouver, B.C.
1945—Walker, O. J., A.M., Ph.D., Head, Department of Chemistry, Director, School of Graduate Studies, University of Alberta, Edmonton, Alta.
1937—Watson, W. H., M.A., Ph.D., Professor and Head, Department of Physics, and Director, Computation Centre, University of Toronto, Toronto, Ont.
1952—Welsh, H. L., M.A., Ph.D., Professor of Physics, University of Toronto, Toronto, Ont.
1955—Wetmore, F. E. W., M.A., Ph.D., Professor of Chemistry, University of Toronto, Toronto, Ont.
1935—Williams, W. L. G., M.A., Ph.D., 1635 Selkirk Ave., Montreal, P.Q.
1946—Winkler, C. A., O.B.E., M.Sc., D.Phil., Professor of Chemistry, McGill University, Montreal, P.Q.
1950—Woonton, G. A., M.A., Professor of Physics, Director Eaton Electronics Research Laboratory, McGill University, Montreal, P.Q.
1956—Wright, G. F., B.Sc., Ph.D., Professor, Department of Chemistry, University of Toronto, Toronto, Ont.
1954—Wright, K. O., M.A., Ph.D., Astrophysicist, Dominion Astrophysical Observatory, Royal Oak, B.C.
1951—Wyman, Max, B.Sc., Ph.D., Associate Professor of Mathematics, University of Alberta, Edmonton, Alta.
1956—Zassenhaus, H. J., M.A., Ph.D., Professor, Department of Mathematics, McGill University, Montreal, P.Q.

Section IV—GEOLOGICAL AND ALLIED SCIENCES

Retired Members

1928—Boyd, W. H., B.A.Sc., 69 Dunvegan Rd., Toronto, Ont.
1928—DeLury, J. S., Ph.D., P.O. Box 22, Uxbridge, Ont.
1920—Graham, R. P. D., D.Sc., 775 Davaar Ave., Outremont, P.Q.
1928—MacKay, B. R., B.Sc., Ph.D., 193 Carling Ave., Ottawa, Ont.
1923—Malcolm, Wyatt, M.A., 376 Hinton Ave., Ottawa, Ont.
1941—Parsons, A. L., B.A., 360 Fairlawn Ave., Toronto, Ont.
1932—Wright, W. J., M.A., Ph.D., LL.D., 117 Church St., Fredericton, N.B.

Active Members

1925—Alcock, F. J., Ph.D., Chief Curator, National Museum of Canada, Ottawa, Ont.
1944—Ambrose, J. W., Ph.D., Professor of Geology, Queen's University, Kingston, Ont.
1950—Armstrong, J. E., M.A.Sc., Ph.D., Geologist, Geological Survey of Canada, 739 W. Hastings St., Vancouver, B.C.

1950—AUGER, P. E., B.Sc., Ph.D., Professor of Geology, Laval University, Quebec, P.Q.
1931—BAKER, M. B., B.Sc., LL.D., Curator of the Geological Museum, Queen's University, Kingston, Ont.
1920—BANCROFT, J. AUSTEN, Ph.D., D.Sc., Consulting Geologist, Anglo American Corporation of South Africa, Johannesburg, South Africa.
1925—BELL, W. A., B.Sc., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.
1951—BERRY, L. G., M.A., Ph.D., Associate Professor of Mineralogy, Queen's University, Kingston, Ont.
1940—BOSTOCK, H. S., M.Sc., Ph.D., Senior Geologist, Geological Survey of Canada, Ottawa, Ont.
1951—BROWNELL, G. M., M.Sc., Ph.D., Professor and Chairman, Department of Geology and Mineralogy, University of Manitoba, Winnipeg, Man.
1955—BYERS, A. R., M.Sc., Ph.D., Associate Professor, Department of Geology, University of Saskatchewan, Saskatoon, Sask.
1948—CALEY, J. F., M.Sc., M.A., Ph.D., Senior Geologist, Geological Survey of Canada, Ottawa, Ont.
1953—CAMPBELL, NEIL, B.Sc., Ph.D., District Geologist, Consolidated Mining and Smelting Company, Trail, B.C.
1918—CAMSELL, CHARLES, C.M.G., LL.D., Commissioner, Federal District Commission, Ottawa, Ont.
1933—CLARK, T. H., M.A., Ph.D., McGill University, Montreal, P.Q.
1943—DENIS, B. T., B.Sc., Ph.D., Bureau of Mines, Quebec, P.Q.
1946—DERRY, D. R., M.A., Ph.D., Executive Vice-President, Rio Canadian Exploration Company, 200 Bay St., Toronto, Ont.
1926—DOLMAGE, Victor, Ph.D., Consulting Geologist, 1318 Marine Bldg., Vancouver, B.C.
1944—DOUGLAS, G. V., M.C., M.Sc., Carnegie Professor of Geology, Dalhousie University, Halifax, N.S.
1950—EDMUNDS, F. H., M.Sc., Professor of Geology, University of Saskatchewan, Saskatoon, Sask.
1952—FAESSLER, CARL, Ph.D., Professor of Mineralogy, Laval University, Quebec, P.Q.
1956—FOLINSBEE, R. E., M.Sc., Ph.D., Professor and Chairman, Department of Geology, University of Alberta, Edmonton, Alta.
1953—FORTIER, Y. O., M.Sc., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.
1950—FRASER, H. J., M.Sc., Ph.D., 44 King St. West, Toronto, Ont. (Life Member)
1955—FREBOLD, HANS, D.Phil., Head, Section of Stratigraphic Palaeontology, Geological Survey of Canada, Ottawa, Ont.
1942—FRITZ, MADELEINE A., M.A., Ph.D., Professor of Palaeontology, University of Toronto, Toronto, Ont.
1947—FURNIVAL, G. M., M.A., Ph.D., 24 Caperton St., Piedmont 11, California, U.S.A.
1938—GILL, J. E., B.Sc., Ph.D., Professor of Geology, McGill University, Montreal, P.Q.
1935—GUNNING, H. C., B.A.Sc., S.M., Ph.D., Dean, Applied Science, Head, Geology and Geography, University of British Columbia, Vancouver, B.C.
1955—GUSSOW, W. C., M.Sc., Ph.D., Union Oil Co., 709 8th Ave. W., Calgary, Alta.
1930—HANSON, GEORGE, M.A., Ph.D., Director, Geological Survey of Canada, Ottawa, Ont.
1952—HARRISON, J. M., M.A., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.
1934—HAWLEY, J. E., M.A., Ph.D., Miller Memorial Research Professor and Chairman, Graduate Studies, Department of Geological Sciences, Queen's University, Kingston, Ont.
1947—HENDERSON, J. F., M.Sc., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.
1956—HEWITT, D.F., M.S., Ph.D., Geologist, Ontario Department of Mines, Toronto, Ont.
1929—HUME, G. S., O.B.E., Ph.D., Westcoast Transmission Co. Ltd., Pacific Bldg., 9th Ave., Calgary, Alberta (Ex-President.)

1940—HURST, M. E., M.A., Ph.D., Provincial Geologist, Ontario Department of Mines, Toronto, Ont.
1954—JAMES, W. F., M.Sc., Ph.D., D.Sc., Consulting Geologist, Suite 1505, 320 Bay St., Toronto, Ont.
1919—JOHNSTON, R. A. A., B.A., 105 Old Forest Hill Rd., Toronto 10, Ont.
1943—JOLLIFFE, A. W., M.A., Ph.D., Queen's University, Kingston, Ont. (Life Member.)
1941—JONES, I. W., B.Sc., Ph.D., Bureau of Mines, Quebec, P.Q.
1948—KINDLE, E. D., M.A., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.
1920—KNIGHT, C. W., B.Sc., Consulting Geologist, 1545 Glenburnie Rd., Port Credit, Ont.
1951—LANG, A. H., M.A., Ph.D., Chief, Radioactive Resources Division, Geological Survey of Canada, Ottawa, Ont.
1940—LANGFORD, G. B., B.A.Sc., Ph.D., Head, Department of Geological Sciences, University of Toronto, Toronto, Ont.
1949—LAVERDIÈRE, l'abbé J. W., L.Sc., D.Sc., Docteur en Droit, Professor of Geology, Laval University, Quebec, P.Q.
1956—LEGGET, R. F., B.Eng., M.Eng., Director, Division of Building Research, National Research Council, Ottawa, Ont.
1949—LORD, C. S., M.A., Ph.D., Chief Geologist, Geological Survey of Canada, Ottawa, Ont.
1952—MACKENZIE, G. S., M.A., Ph.D., University of New Brunswick, Fredericton, N.B.
1933—MAWDSLEY, J. B., B.Sc., Ph.D., University of Saskatchewan, Saskatoon, Sask.
1947—MCGERRIGLE, H. W., Ph.D., Geologist, Quebec Department of Mines, Quebec, P.Q.
1927—MCLEARN, F. H., B.E., Ph.D., 817 Ivanhoe Ave., Britannia Heights (Ottawa), Ont.
1924—MOORE, E. S., M.A., Ph.D., LL.D., Department of Geological Sciences, University of Toronto, Toronto, Ont. (Ex-President.)
1937—NORMAN, G. W. H., B.A.Sc., Ph.D., Geologist, Newmont Mining Corporation, P.O. Box 658, Montrose, Colorado, U.S.A.
1945—OKULITCH, V. J., M.A.Sc., Ph.D., Professor and Chairman, Division of Geology, University of British Columbia, Vancouver, B.C.
1925—O'NEILL, J. J., M.Sc., Ph.D., D.Sc., 3246 The Boulevard, Westmount, P.Q. (Ex-President.)
1937—OSBORNE, F. F., M.A.Sc., Ph.D., Professor of Petrology, Laval University, Quebec, P.Q.
1927—POITEVIN, EUGÈNE, B.A.Sc., D.Sc., Chief, Mineralogy Division, Geological Survey of Canada, Ottawa, Ont.
1946—RICE, H. M. A., M.A.Sc., Ph.D., Chief Geological Editor, Geological Survey of Canada, Ottawa, Ont.
1956—RIDDELL, J. E., B.Eng., M.Sc., Ph.D., Associate Professor, Department of Geological Sciences, McGill University, Montreal, P.Q.
1936—RICKABY, H. C., M.A., Deputy Minister of Mines, Parliament Bldgs., Toronto, Ont.
1954—ROBINSON, S. C., M.A.Sc., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.
1954—ROLIFF, W. A., B.Sc., Manager, Eastern Division, Producing Dept., Imperial Oil Ltd., 56 Church St., Toronto, Ont.
1936—RUSSELL, L. S., M.A., Ph.D., Chief Zoologist, National Museum of Canada, Ottawa, Ont.
1954—SATTERLY, JACK, M.A., Ph.D., Geologist, Ontario Department of Mines, Toronto, Ont.
1938—SLIPPER, S. E., B.Sc., 13051, 9th Ave., N.W., Seattle, Wash., U.S.A.
1955—SPROULE, J. C., M.A., Ph.D., J. C. Sproule and Associates, Geological Consultants, 901–8th Ave. West, Calgary, Alta.
1949—STERNBERG, C. M., 169 Holmwood Ave., Ottawa, Ont.
1949—STEVENSON, J. S., B.A.Sc., Ph.D., Associate Professor of Mineralogy, McGill University, Montreal, P.Q.

1936—Stockwell, C. H., B.A.Sc., Ph.D., Senior Geologist, Geological Survey of Canada Ottawa, Ont.
1939—Swanson, C. O., M.A.Sc., Ph.D., Chief Geologist, Consolidated Mining & Smelting Co., Ltd., Trail, B.C.
1927—Tanton, T. L., M.A., Ph.D., Consulting Geologist, 9 Grosvenor Ave., Ottawa, Ont.
1945—Thomson, J. E., M.A., Ph.D., Assistant Provincial Geologist, Department of Mines, Toronto, Ont.
1910—Tyrrell, J. B., M.A., B.Sc., LL.D., 14 Walmer Rd., Toronto, Ont. (Life Member.)
1937—Walker, J. F., B.A.Sc., Ph.D., Deputy Minister of Mines, Province of British Columbia, Victoria, B.C.
1945—Warren, H. V., B.Sc., D.Phil., Professor, Department of Geology and Geography, University of British Columbia, Vancouver, B.C.
1931—Warren, P. S., Ph.D., A.R.C.S., Head of Department and Professor of Geology, University of Alberta, Edmonton, Alta.
1953—Watson, J. W., M.A., Ph.D., Professor of Geography, Edinburgh University, Edinburgh, Scotland.
1953—Weeks, L. J., B.Sc., M.A., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.
1939—Wickenden, R. T. D., Ph.B., M.A., Ph.D., 406 Customs Bldg., Calgary, Alta.
1926—Williams, M. Y., B.Sc., Ph.D., Professor Emeritus of Geology, University of British Columbia, Vancouver, B.C.
1938—Wilson, Alice E., M.B.E., Ph.D., 328 McLeod St., Ottawa, Ont.
1948—Wilson, J. Tuzo, O.B.E., Legion of Merit (USA) M.A., Ph.D., Professor of Geophysics, University of Toronto, Toronto, Ont.
1924—Wilson, M. E., Ph.D., 22 Monkland Ave., Ottawa, Ont.
1932—Wright, J. F., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.

Section V.—BIOLOGICAL SCIENCES

Retired Members

1924—Boyd, William, M.D., LL.D., D.Sc., 40 Arjay Crescent, Willowdale, Ont.
1919—Cameron, John, M.D., D.Sc.
1946—Craigie, James, O.B.E., M.B., Ph.D., D.P.H., F.R.S., Imperial Cancer Research Fund, Burtonhole Lane, The Ridgeway, Mill Hill, N.W. 7, London, England.
1921—Faull, J. H., Ph.D., 72 Fresh Pond Lane, Cambridge 38, Mass., U.S.A.
1922—Gibson, Arthur, LL.D., 183 King St. E., Brockville, Ont.
1931—Gussow, H. T., LL.D., F.R.M.S., Hon. F.R.H.S., 2605 Killarney Rd., Victoria, B.C.
1916—Hunter, Andrew, C.B.E., M.A., B.Sc., M.B., Ch.B., F.R.S.E., 2 Sultan St., Toronto, Ont.
1943—Kirk, L. E., M.S.A., Ph.D., Food and Agricultural Organization of U.N., Rome, Italy.
1911—Leathes, J. B., B.Ch., Sheffield, England.
1932—Macallum, A. B., M.B., M.D., Ph.D., University of Western Ontario, London, Ont.
1937—Marrian, G. F., D.Sc., F.R.I.C., F.R.S., Department of Medical Chemistry, University of Edinburgh, Edinburgh, Scotland.
1937—McDunnough, J. H., M.A., Ph.D., Nova Scotia Museum of Science, Halifax, N.S.
1926—Meakins, J. C., C.B.E., M.D., C.M., M.D., LL.D., F.A.C.P., F.R.C.P.(C), F.R.S.E., 3640 University St., Montreal, P.Q.
1922—Miller, James, M.D., D.S.C., F.R.C.P.E., F.R.C.P.(C), Painswick House, near Stroug, Gloucestershire, England.
1922—Miller, F. R., M.A., M.B., M.D., F.R.C.P.(C), F.R.S., 280 Carlton St., Toronto, Ont.
1930—Newton, Robert, M.C., B.S.A., M.Sc., Ph.D., 1972 Robson St., Vancouver 8, B.C.

1922—O'Donoghue, C. H., D.Sc., F.R.S.E., University of Reading, Reading, England.
1915—Walker, E. M., M.B., 120 Cheltenham Ave., Toronto, Ont.
1932—Whitnall, S. E., M.A., M.D., B.Ch., M.R.C.S.

Active Members

1944—Anderson, J. A., M.Sc., Ph.D., Chief Chemist, Board of Grain Commissioners for Canada, Winnipeg, Man.
1939—Anderson, R. M., B.Ph., Ph.D., 58, The Driveway, Ottawa, Ont.
1937—Bailey, D. L., M.S., Ph.D., Professor of Botany, University of Toronto, Toronto, Ont.
1952—Bannan, M. W., Ph.D., Associate Professor of Botany, University of Toronto, Toronto, Ont.
1936—Berrill, N. J., Ph.D., D.Sc., F.R.S., Strathcona Professor of Zoology, McGill University, Montreal, P.Q.
1956—Bernard, Richard, M.Sc., Ph.D., Professeur titulaire de physiologie animale, département de biologie, Université Laval, Québec, P.Q.
1931—Best, C. H., C.B.E., M.A., M.D., D.Sc., LL.D., F.R.S., Professor and Head of Department of Physiology and Director of Banting & Best Department of Medical Research, Charles H. Best Institute, University of Toronto, Toronto, Ont.
1956—Black, E. C., M.B.E., M.A., Ph.D., Associate Professor, Department of Physiology, University of British Columbia, Vancouver, B.C.
1936—Brittain, W. H., B.S.A., M.S., Ph.D., D.Sc., Dean, Faculty of Agriculture of McGill University, and Vice-Principal of Macdonald College, P.Q.
1939—Browne, J. S. L., B.Sc., M.D., C.M., Ph.D., LL.D., Director, McGill University Clinic, Professor and Chairman of Investigative Medicine, McGill University, Montreal, P.Q.
1952—Burton, A. C., M.B.E., B.Sc., M.A., Ph.D., Professor of Biophysics, University of Western Ontario, London, Ont.
1939—Cameron, T. W. M., T.D., M.A., Ph.D., D.Sc., M.R.C.V.S., Professor and Chairman, Department of Parasitology, McGill University, Director, Institute of Parasitology, Macdonald College, P.Q.
1933—Campbell, W. R., M.A., M.D., Medical Arts Bldg., Toronto, Ont.
1955—Cantero, Antonio, M.D., C.M., Director of Research Notre Dame Hospital, Montreal Cancer Institute, Montreal, P.Q.
1925—Clemens, W. A., M.A., Ph.D., Director, Institutes of Oceanography and Fisheries, University of British Columbia, Vancouver, B.C.
1954—Collier, H. B., M.A., Ph.D., Professor and Head, Department of Biochemistry, University of Alberta, Edmonton, Alta.
1925—Collip, J. B., C.B.E., Ph.D., M.D., D.Sc., LL.D., F.R.S., Dean of Medicine, University of Western Ontario, London, Ont. (Ex-President.)
1944—Cone, W. V., B.S., M.D., Professor of Neurosurgery, McGill University, Neurosurgeon-in-Chief, Royal Victoria Hospital and Montreal Neurological Institute, Montreal, P.Q.
1943—Cook, W. H., O.B.E., M.Sc., Ph.D., LL.D., Director, Division of Applied Biology, National Research Council, Ottawa, Ont.
1946—Cowan, Ian McT., Ph.D., Head, Department of Zoology, University of British Columbia, Vancouver, B.C.
1935—Craigie, E. Horne, Ph.D., Professor of Comparative Anatomy and Neurology, Department of Zoology, University of Toronto, Toronto, Ont.
1936—Craigie, J. H., M.S., Ph.D., D.Sc., LL.D., F.R.S., Principal Plant Pathologist, Science Service, Department of Agriculture, Ottawa, Ont.
1945—Crampton, E. W., M.Sc., Ph.D., Professor and Chairman, Department of Nutrition, Professor of Animal Husbandry, Macdonald College, P.Q.

1949—DANSEREAU, PIERRE, B.Sc.Agr., D.Sc., Doyen de la faculté des sciences pures, Université de Montréal, Montréal (P.Q.)

1953—DAUPHINEE, J. A., O.B.E., M.A., Ph.D., M.D., Professor of Pathological Chemistry and Head of the Department, University of Toronto, Toronto, Ont.

1952—DAVIAULT, LIONEL, L.Sc.A., M.Sc., D.Sc., Officer in Charge, Laboratory of Forest Zoology, Science Service, Canadian Department of Agriculture, Quebec, P.Q.

1947—DOLMAN, C. E., M.B., B.S., D.P.H., Ph.D., Professor and Head, Department of Bacteriology & Immunology, University of British Columbia, Vancouver, B.C.

1938—DRAYTON, F. L., B.S.A., Ph.D., Associate Chief, Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa, Ont.

1947—DUFF, G. LYMAN, M.A., M.D., Ph.D., Strathcona Professor of Pathology and Dean of the Faculty of Medicine, McGill University, Montreal, P.Q.

1951—DUGAL, L.-PAUL, O.B.E., M.A., Ph.D., Département de biologie, Université d'Ottawa, Ottawa, Ont.

1954—DUNBAR, M. J., M.A., Ph.D., Associate Professor of Zoology, McGill University, Montreal, P.Q.

1938—DYMOND, J. R., O.B.E., M.A., D.Sc., Head, Department of Zoology, University of Toronto, Toronto, Ont.

1952—EAGLES, BLYTHE, M.A., Ph.D., Dean, Faculty of Agriculture, and Head, Department of Dairying, University of British Columbia, Vancouver, B.C.

1941—ETTINGER, G. H., M.B.E., M.D., C.M., Dean, Faculty of Medicine, Queen's University, Kingston, Ont.

1948—FERGUSON, J. K. W., M.B.E., M.A., M.D., Connaught Medical Research Laboratories, University of Toronto, Toronto, Ont.

1949—FISHER, K. C., M.A., Ph.D., Professor of Zoology; Chairman, Div. 2 (Science), School of Graduate Studies, University of Toronto, Toronto, Ont.

1939—FOERSTER, R. E., M.A., Ph.D., Principal Scientist, Fisheries Research Board, Biological Station, Nanaimo, B.C.

1949—FRAPPIER, ARMAND, O.B.E., M.D., L.ès Sc., Officier d'Académie (avec palmes), Professor and Director, Department of Bacteriology, University of Montreal, Montreal, P.Q.

1948—FRY, F. E. J., M.B.E., M.A., Ph.D., Associate Professor of Limnology, Department of Zoology, University of Toronto, Toronto, Ont.

1952—GIBBARD, JAMES, B.S.A., S.M., Director, Laboratory of Hygiene, Department of National Health & Welfare, Ottawa, Ont.

1939—GIBBS, R. D., M.Sc., Ph.D., Professor of Botany, McGill University, Montreal, P.Q.

1955—GIBBONS, N. E., M.A., Ph.D., Head, Food Microbiology Section, Division of Applied Biology, National Research Council, Ottawa, Ont.

1941—GOULDEN, C. H., M.S.A., Ph.D., LL.D., Chief, Cereal Crops Division, Department of Agriculture, Ottawa, Ont.

1948—GRACE, N. H., M.B.E., M.A., Ph.D., Director, Research Council of Alberta, Edmonton, Alta.

1938—GRAHAM, D. A., C.B.E., M.B., F.R.C.P.(London), 343 Lytton Blvd., Toronto, Ont.

1951—GROVES, J. W., M.A., Ph.D., Head, Mycology Unit, Science Service, Department of Agriculture, Ottawa, Ont.

1944—HALL, G. E., M.S.A., M.D., Ph.D., D.ès Sc., LL.D., President and Vice-Chancellor, University of Western Ontario, London, Ont.

1951—HAM, A. W., M.B., Professor of Anatomy, University of Toronto, Toronto, Ont.

1944—HANNA, W. F., C.B.E., M.Sc., Ph.D., LL.D., Chief, Botany and Plant Pathology Division, Department of Agriculture, Ottawa, Ont.

1956—HANES, C. S., Ph.D., Sc.D., F.R.S., Professor of Biochemistry, Department of Chemistry, University of Toronto, Toronto, Ont.

1943—HART, J. L., M.A., Ph.D., Director, Biological Station, Fisheries Research Board, St. Andrews, N.B.

1947—HAYES, F. R., M.Sc., Ph.D., D.Sc., G. S. Campbell Professor of Biology and Head of the Department, Dalhousie University, Halifax, N.S.

1953—HEIMBURGER, C. C., M.Sc.F., Ph.D., Biologist in charge of forest tree breeding, Ontario Department of Lands and Forests, Maple, Ont.

1955—HOAR, W. S., M.A., Ph.D., Professor of Zoology and Fisheries, University of British Columbia, Vancouver, B.C.

1951—HOPKINS, J. W., M.Sc., Ph.D., National Research Council, Ottawa, Ont.

1947—HUNTSMAN, A. G., B.A., M.D., St. Andrews, N.B. (Ex-President.)

1933—HUTCHINSON, A. H., M.A., Ph.D., Emeritus Professor and Special Lecturer, Department of Biology & Botany, University of British Columbia, Vancouver, B.C.

1952—JAQUES, L. B., M.A., Ph.D., Professor and Head, Department of Physiology, University of Saskatchewan, Saskatoon, Sask.

1950—JOHNSON, T., B.S.A., M.Sc., Ph.D., Officer in Charge, Plant Pathology Laboratory, Science Service, Canada Agriculture, Winnipeg, Man.

1950—KROTKOV, G., M.A., Ph.D., Professor of Biology, Queen's University, Kingston, Ont.

1945—LABARRE, JULES, B.Ph., L.ès S., D.ès S., Professeur de pharmacie, Université de Montréal, Montréal, (P.Q.)

1946—LARMOUR, R. K., M.Sc., Ph.D., Director of Research, Maple Leaf Milling Co., Limited, Toronto 9, Ont.

1945—LEACH, W., M.Sc., Ph.D., D.Sc., Dencross Terrace, Saanichton, B.C.

1951—LEBLOND, C. P., M.D., L.ès Sc., Ph.D., D.Sc., Professor of Anatomy, McGill University, Montreal, P.Q.

1949—LEDINGHAM, G. A., M.B.E., M.Sc., Ph.D., Director, Prairie Regional Laboratory, Saskatoon, Sask.

1940—LOCHHEAD, A. G., M.Sc., Ph.D., Chief, Bacteriology Division, Science Service, Department of Agriculture, Ottawa, Ont.

1956—MACINTOSH, F. C., M.A., Ph.D., F.R.S., Joseph Morley Drake Professor of Physiology and Chairman of Department, McGill University, Montreal, P.Q.

1924—MACKLIN, C. C., M.B., M.D., M.A., Ph.D., D.Sc., 37 Gerrard St., London, Ont.

1944—MAHEUX, GEORGES, M.A., I.F., M.Sc.Ag., D.Sc., Professeur, Faculté de Génie forestier, Université Laval, Québec (P.Q.)

1941—MAINLAND, D., M.B., Ch.B., D.Sc., F.R.S.E., Professor of Medical Statistics and Chairman of Department, New York University College of Medicine, New York, N.Y.

1931—MASSON, C. L. P., L.ès Sc., M.D., Docteur Honoris Causa de l'Université de Montréal et de l'Université McGill, Directeur du département d'Anatomie pathologique, Université de Montréal, Montréal (P.Q.)

1953—MCCALLA, A. G., M.Sc., Ph.D., Dean, Faculty of Agriculture, Professor of Plant Science, University of Alberta, Edmonton, Alta.

1942—MCFARLANE, W. D., M.A., B.Sc.(Agr.), Ph.D., Director of Research, Canadian Breweries Limited, Research Division, 307 Fleet St. E., Toronto, Ont.

1942—MCHENRY, E. W., M.A., Ph.D., Professor of Public Health Nutrition, University of Toronto, Toronto, Ont.

1945—MITCHELL, C. A., B.V.Sc., D.V.M., Chief, Division of Animal Pathology, Department of Agriculture, Animal Diseases Research Institute, Hull, P.Q.

1936—MOLONEY, P. J., O.B.E., M.A., Ph.D., Connaught Laboratories, University of Toronto, Toronto, Ont.

1938—MOORHOUSE, V. H. K., M.C., B.A., M.B., M.D., Box 569, Orangeville, Ont.

1950—MORIN, J. E., M.D., M.C.R.M.(C), C.M.C.P.Q., Professeur de bactériologie, directeur des laboratoires, Université Laval, Québec (P.Q.)

1947—MORRELL, C. A., M.A., Ph.D., Director, Food and Drug Divisions, Department of National Health and Welfare, Ottawa, Ont.

1938—Moss, E. H., M.A., Ph.D., Professor of Botany and Head of the Department, University of Alberta, Edmonton, Alta.

1938—Murray, E. G. D., O.B.E., M.A., L.M.S.S.A., M.D., D.Sc., 126 Regent St., London, Ont.

1947—Neatby, K. W., M.S.A., Ph.D., LL.D., Director, Science Service, Department of Agriculture, Ottawa, Ont.

1954—Neave, Ferris, M.Sc., Ph.D., Principal scientist, Fisheries Research Board, Biological Station, Nanaimo, B.C.

1945—Needler, A. W. H., O.B.E., M.A., Ph.D., D.Sc., Director, Fisheries Research Board, Biological Station, Nanaimo, B.C.

1942—Newton, Margaret, B.S.A., M.Sc., Ph.D., 2392 Beach Dr., Victoria, B.C.

1950—Noble, R. L., M.D., Ph.D., D.Sc., Professor and Associate Director, Collip Medical Research Laboratory, University of Western Ontario, London, Ont.

1953—Orr, J. H., M.D., C.M., F.R.C.P.(C), Queen's University, Kingston, Ont.

1955—Pagé, E., M.B.E., B.S.A., Ph.D., Directeur de l'Institut de Biologie, Université de Montréal, Case postale 6128, Montréal (P.Q.)

1935—Penfield, Wilder G., O.M., C.M.G., Litt.B., M.D., M.A., B.Sc., D.Sc., F.R.S., Professor and Chairman of Neurology and Neuro-Surgery; Director, Montreal Neurological Institute, Montreal, Que.

1948—Pomerleau, René, B.S.A., M.Sc., D.Sc., Chef de laboratoire, Lab. de biologie forestière, Section pathologie, Université Laval, Québec (P.Q.)

1946—Porsild, A. E., M.B.E., B.A., Ph.D., Chief Botanist and Keeper of the National Herbarium of Canada, National Museum, Ottawa, Ont.

1942—Préfontaine, Georges, M.D., Lic.Sc., Docteur honoris causa de l'Université d'Alger, Directeur des laboratoires, Hôpital Sanatorium Saint-Joseph, Montréal (P.Q.)

1953—Quastel, J. H., A.R.C.S., B.Sc., Ph.D., D.Sc., F.R.S., Professor of Biochemistry, McGill University, and Director, Research Institute, Montreal General Hospital, Montreal, P.Q.

1944—Rawson, Donald S., M.A., Ph.D., Professor and Head, Department of Biology, University of Saskatchewan, Saskatoon, Sask.

1954—Raymond, Marcel, L.Sc., Botaniste, taxonomiste, Jardin Botanique de Montréal, Montréal (P.Q.)

1956—Rempel, J. G., M.Sc., Ph.D., Professor, Department of Biology, University of Saskatchewan, Saskatoon, Sask.

1956—Ricker, W. E., M.A., Ph.D., Editor, Fisheries Research Board, Biological Station, Nanaimo, B.C.

1954—Rossiter, R. J., B.Sc., M.A., D.Phil., B.M.B.Ch., D.M., Professor and Head, Department of Biochemistry, University of Western Ontario, London, Ont.

1942—Rousseau, Jacques, B.A., L.Sc., D.Sc., Ph.D., Directeur, Jardin botanique de Montréal, Montréal (P.Q.)

1934—Rowan, William, D.Sc., F.Z.S., Professor of Zoology, University of Alberta, Edmonton, Alta.

1939—Scott, D. A., M.A., Ph.D., F.R.S., Research member, Connaught Medical Research Laboratories, University of Toronto, Toronto 5, Ont.

1941—Selye, Hans, M.D., Ph.D., D.Sc., Professor and Director of the Institute of Experimental Medicine and Surgery, University of Montreal, Montreal, P.Q.

1955—Senn, H. A., M.A., Ph.D., Head, Botany Unit, Botany & Plant Pathology Division, Science Service, Dept. of Agriculture, Ottawa, Ont.

1946—Shaner, R. F., Ph.B., Ph.D., Professor of Anatomy, University of Alberta, Edmonton, Alta.

1935—Sifton, H. B., M.A., Ph.D., Head, Department of Botany, University of Toronto, Toronto, Ont.

1940—Simard, L. C., M.D., F.R.C.P.(C), Associate Professor of Pathological Anatomy, University of Montreal, Montreal, P.Q.

1948—SOLANDT, O. M., O.B.E., B.Sc., M.A., M.D., M.R.C.P., LL.D., Vice-President, Research and Development, Canadian National Railways, Montreal, P.Q.

1951—SPEAKMAN, H. B., B.Sc., M.Sc., D.Sc., LL.D., Director, Ontario Research Foundation, Toronto, Ont.

1953—STRICKLAND, E. H., M.Sc., D.Sc., 3012 Sea View Road, Victoria, B.C.

1950—TEMPLEMAN, W., O.B.E., B.Sc., M.A., Ph.D., Director, Newfoundland Fisheries Research Station, St. John's, Newfoundland.

1947—THOMPSON, I. M., B.Sc., M.B., Ch.B., F.R.S.E., Professor of Anatomy and Chairman of the Department, University of Manitoba, Winnipeg, Man.

1921—THOMPSON, W. P., M.A., Ph.D., D.Sc., LL.D., President, University of Saskatchewan, Saskatoon, Sask. (Ex-President.)

1949—THOMPSON, W. R., B.S.A., D.Sc., Ph.D., F.R.S., Director, Commonwealth Bureau of Biological Control, Ottawa, Ont.

1936—THOMSON, D. L., M.A., B.Sc., Ph.D., LL.D., Vice-Principal, Gilman Cheney Professor of Biochemistry and Dean of the Faculty of Graduate Studies, McGill University, Montreal, P.Q.

1950—TREMBLAY, J.-L., B.Sc., D.Sc., Professor of Marine Biology, Laval University, Quebec, P.Q.

1955—VENNING, ELEANOR H., M.Sc., Ph.D., Associate Professor of Experimental Medicine, McGill University, Montreal, P.Q.

1934—WARDLE, R. A., M.Sc., Professor of Zoology, University of Manitoba, Winnipeg, Man.

1930—WASTENEYS, H., Ph.D., Professor Emeritus of Biochemistry, University of Toronto, Toronto, Ont.

1943—WYNNE, A. M., M.A., Ph.D., Head, Department of Biochemistry, University of Toronto, Toronto, Ont.

1940—WYNNE-EDWARDS, V. C., M.A., Professor of Natural History, Marsichall College, University of Aberdeen, Aberdeen, Scotland.

1935—YOUNG, E. GORDON, M.Sc., Ph.D., Director of the Maritime Regional Laboratory, National Research Council Laboratories, Halifax, N.S.

CORRESPONDING MEMBERS

SECTION I

DE LACRETELLE, JACQUES, de l'Académie française, Paris.

SECTION II

SIEBERT, WILBUR H., M.A., 182 West Tenth Ave., Columbus, Ohio, U.S.A.

SECTION IV

WATTS, W. W., Imperial College of Science and Technology, London, England.

MEDAL AWARDS

MEDAILLE PIERRE CHAUVEAU

(Founded 1952)

1952—Pierre Daviault
1953—B. K. Sandwell, LL.D., D.C.L.
1954—Gérard Morisset, B.A., LL.L.
1955—Jean-Marie Gauvreau, D.Sc.Pol.
1956—Victor Morin, B.A., LL.D., O.I.P., Ch. Grand'Croix de l'Ordre du Saint-Sépulcre de Jérusalem

FLAVELLE MEDAL

(Founded 1925)

1946—William Rowan, D.Sc., F.Z.S.
1947—G. B. Reed, O.B.E., M.A., B.Sc., Ph.D., LL.D.
1948—Margaret Newton, B.S.A., M.Sc., Ph.D.
1949—W. P. Thompson, M.A., Ph.D., D.Sc.
1950—C. H. Best, C.B.E., M.A., M.D., D.Sc., F.R.C.P.(C), F.R.S., Hon. D.Sc.(Oxon.)
1951—Wilder G. Penfield, C.M.G., Litt.B., M.D., M.A., B.Sc., D.Sc., F.R.S.
1952—A. G. Huntsman, M.D.
1953—E. G. D. Murray, O.B.E., M.A., L.M.S.S.A.
1954—D. A. Scott, M.A., Ph.D., F.R.S.
1955—C. S. Hanes, Ph.D., Sc.D., F.R.S.
1956—George Lyman Duff, M.A., M.D., Ph.D.

HENRY MARSHALL TORY MEDAL

(Founded 1943)

1943—John L. Synge, M.A., Sc.D., F.R.S.
1944—Frank Allen, M.A., Ph.D., LL.D.
1945—Otto Maass, C.B.E., M.Sc., Ph.D., LL.D., F.R.S.
1946—John S. Foster, B.Sc., Ph.D., F.R.S.
1947—E. F. Burton, O.B.E., Ph.D.
1949—H. S. M. Coxeter, Ph.D., F.R.S.
1951—T. Thorvaldson, A.M., Ph.D.
1953—G. Herzberg, M.A., Dipl.Ing., Dr.Ing., F.R.S.
1955—E. W. R. Steacie, O.B.E., M.Sc., Ph.D., D.Sc., LL.D., F.R.S.

LORNE PIERCE MEDAL

(Founded 1926)

1946—Charles N. Cochrane, M.A. (posthumously)
1947—Dorothy Livesay (Mrs. Duncan Macnair)
1948—Gabrielle Roy (Mme Carbotte)
1949—John Murray Gibbon, B.A., D. ès L.
1950—Marius Barbeau, LL.L., B.Sc., D. ès L., Dipl.Anth.
1951—E. K. Brown, B.A., D. ès L. (posthumously)

LORNE PIERCE MEDAL (*cont'd*)

1952—Hugh MacLennan, M.A., Ph.D.
1953—Earle Birney, Ph.D.
1954—Alain Grandbois
1955—William Bruce Hutchison
1956—Thomas H. Raddall, LL.D.

TYRRELL MEDAL
(Founded 1928)

1946—A. L. Burt, M.A.
1947—A. R. M. Lower, Ph.D., LL.D.
1948—Le chanoine Lionel Groulx, Ph.D., D.Th., D. ès L.
1949—Reginald G. Trotter, M.A., Ph.D., D.C.L.
1950—John Bartlet Brebner, M.A., B. Litt., Ph.D., Litt.D.
1951—Jean Bruchési, LL.L., D.Sc.Pol., D. ès L., and
D. G. Creighton, M.A., LL.D.
1952—C. B. Sissons, LL.D.
1953—Séraphin Marion, M.A., D. ès L.
1954—G. de T. Glazebrook
1955—C. P. Stacey, O.B.E., A.M., Ph.D.
1956—Mgr Olivier Maurault, C.M.G., P.D., LL.D., p.SS., D.ès L., D.C.L.

WILLET G. MILLER MEDAL
(Founded 1943)

1943—Norman Levi Bowen, M.A., Ph.D., Sc.D.
1945—Morley E. Wilson, Ph.D.
1947—F. H. McLearn, B.E., Ph.D.
1949—H. V. Ellsworth, M.A., Ph.D.
1951—J. E. Hawley, M.A., Ph.D.
1953—C. H. Stockwell, B.A.Sc., Ph.D.
1955—J. Tuzo Wilson, O.B.E., Legion of Merit (U.S.A.), M.A., Ph.D.

PRESIDENTS

1946-1947 . . . Harold A. Innis, M.A., Ph.D.
1947-1948 . . . W. P. Thompson, M.A., Ph.D., D.Sc.
1948-1949 . . . Gustave Lanctôt, D.ès L., LL.M., LL.D., D.Sc.Pol., C.R.
1949-1950 . . . Joseph A. Pearce, M.A., Ph.D.
1950-1951 . . . J. J. O'Neill, M.Sc., Ph.D.
1951-1952 . . . H. F. Angus, M.A., B.C.L., LL.D.
1952-1953 . . . G. B. Reed, O.B.E., M.A., B.Sc., Ph.D., LL.D.
1953-1954 . . . Jean Bruchési, LL.L., D.Sc.Pol., D. ès L.
1954-1955 . . . E. W. R. Steacie, O.B.E., Ph.D., D.Sc., F.R.S.
1955-1956 . . . G. S. Hume, O.B.E., Ph.D.
1956-1957 . . . W. A. Mackintosh, C.M.G., M.A., Ph.D., LL.D., D.C.L.

LIST OF PRESIDENTS OF SECTIONS

SECTION I

1946-1947	Pierre Daviault
1947-1948	Arthur Saint-Pierre
1948-1949	Léopold Houlé
1949-1950	Le chanoine Georges Robitaille
1950-1951	Donatien Frémont
1951-1952	L'abbé Arthur Maheux
1952-1953	Claude Melançon
1953-1954	Gérard Morisset
1954-1955	Jean Chauvin
1955-1956	Eugène L'Heureux
1956-1957	Jean-Marie Gauvreau

SECTION II

1946-1947	Alexander Brady
1947-1948	R. K. Gordon
1948-1949	B. K. Sandwell
1949-1950	A. G. Dorland
1950-1951	W. A. Mackintosh
1951-1952	A. S. P. Woodhouse
1952-1953	A. R. M. Lower
1953-1954	F. M. Salter
1954-1955	D. A. MacGibbon
1955-1956	J. S. Thomson
1956-1957	W. Kaye Lamb

SECTION III

1946-1947	E. L. Harrington
1947-1948	E. W. R. Steacie
1948-1949	J. S. Foster
1949-1950	C. S. Beals
1950-1951	H. G. Thode
1951-1952	Gerhard Herzberg
1952-1953	R. L. Jeffery
1953-1954	P. E. Gagnon
1954-1955	R. M. Petrie
1955-1956	W. H. Watson
1956-1957	H. S. M. Coxeter

SECTION IV

1946-1947	Bruce Rose
1947-1948	F. J. Alcock
1948-1949	Victor Dolmage
1949-1950	T. L. Tanton
1950-1951	P. S. Warren
1951-1952	G. S. Hume
1952-1953	G. Hanson
1953-1954	T. H. Clark
1954-1955	J. B. Mawdsley
1955-1956	J. E. Hawley
1956-1957	H. C. Gunning

SECTION V

1946-1947	J. R. Dymond
1947-1948	E. Gordon Young
1948-1949	A. H. Hutchinson
1949-1950	T. W. M. Cameron
1950-1951	L. C. Simard
1951-1952	C. L. Huskins
1952-1953	W. A. Clemens
1953-1954	R. D. Gibbs
1954-1955	E. G. D. Murray
1955-1956	Georges Maheux
1956-1957	W. H. Cook

ASSOCIATED ORGANIZATIONS

The Canadian Institute of Mining and Metallurgy

THE ROYAL SOCIETY OF CANADA

REPORT OF THE HONORARY SECRETARY FOR THE YEAR 1955-1956

COUNCIL MEETINGS

The Council held three meetings during the year to conduct the affairs of the Society. The Report of Council presented to the annual meeting of the Royal Society of Canada contains a complete account of the year's business.

The Sections recommended the election of twenty-six Fellows. Their names, and the Sections to which they were elected, appear under "Annual Meeting."

Four medals were awarded by the Society:

Médaille Pierre Chauveau to Docteur Victor Morin
Flavelle Medal to Dr. George Lyman Duff
Lorne Pierce Medal to Dr. Thomas H. Raddall
Tyrrell Medal to Mgr Olivier Maurault

(Citations are given on pages 36–39).

On the recommendation of the Scholarships Board, two post-doctoral and two pre-doctoral scholarships were awarded to the following:

Allan R. Bevan, of Dalhousie University, a post-doctoral scholarship for the study of John Dryden as a dramatic artist, at the British Museum in the United Kingdom.

John Whichello Graham, of the University of Western Ontario, a post-doctoral scholarship to study English literature (Modern Novel).

David P. Gauthier, of Toronto, a pre-doctoral scholarship to study Ethics at the University of Oxford.

Mlle Nicole Deschamps, of Quebec City, a pre-doctoral scholarship to carry on research at the Sorbonne, Paris.

One Rutherford Memorial Scholarship of $500 was awarded, to supplement a National Research Council post-doctoral fellowship, to Douglas West Allan, who will study at the University of Cambridge, in the Department of Geodesy and Geophysics, under Professor R. Stoneley.

Canadian Government Overseas Awards were offered for the fifth time in 1956. Twelve fellowships and sixteen scholarships were awarded for 1956-1957 to the following recipients:

Fellowships

Anthropology
Banim, Rev. Father Farrell E.

Archaeology
Harper, John R.

Art (Creative)
Nichols, Jack
Shadbolt, Jack L.

Art (History and Education)
McCullough, Norah
Shepherd, Reginald S.

Biology
Kleerekoper, Herman

Geography
Hamelin, Louis E.

Literature
Labelle, Edmond
Lapointe, Jeanne

Physics
Welsh, H. L.

Typography
Dair, Carl

Scholarships

Art (Creative)
Alleyn, George E.
Matte, Denys

Education
Parent, Charles E.

Languages
Beaudry, Mimi*
Gendron, Jean-D.

Literature
DeChantal, René
Hood, James A.
Lapointe, Gatien
Person, Lloyd H.*
Roy, George R.

Oceanography
Légaré, J. E. Henri

Philosophy
Santoni, Ronald E.

Political Geography
Armstrong, Dorothy J.

Theatre
Black, James A.
Trudel, Robert E.

Zoology
Barlow, Carl A.

The asterisk indicates that these two scholarships were renewals of awards made last year. No fellowships were renewed.

A translation of the By-laws as revised and approved at the 1955 Annual Meeting has been distributed to all members of the Society.

A Finance Committee was appointed by the Council to develop a general financial policy for the Society and to review annually or oftener if desired the investments of the Honorary Treasurer.

The Executive Committee appointed a Programme Committee for the celebration of the 75th Anniversary of the Royal Society of Canada in June, 1957.

There were ten retirements: W. H. Alexander, R. H. Coats, R. Flenley, D. Jenness, R. C. Lodge and H. A. Logan, Section II; J. A. McRae, Section III; W. J. Wright, Section IV; W. Boyd and J. C. Meakins, Section V.

ANNUAL MEETING

The annual meeting was opened in the Auditorium of the University of Montreal, at 10 A.M., June 11. The following Fellows registered:

SECTION I

Audet, Louis-Philippe; Bonenfant, Jean-Charles; Bouchard, Georges; Brouillette, Benoit; Bruchési, Jean; Daviault, Pierre; Falardeau, Jean-C.; Faribault, Marcel; Frémont, Donatien; Gauvreau, Jean-Marie; Lamontagne, Maurice; Lanctôt, Gustave; Lebel, Maurice; Lefebvre, Jean-Jacques; L'Heureux, Eugène; Lortie, Léon; Maurault, Mgr Olivier; Melançon, Claude; Morin, Victor; Morisset, Gérard; Plouffe, Adrien; Régis, le R. P. Louis-Marie; Roy, Antoine; Simard, le R. P. Georges; Vallerand, Jean

SECTION II

Alexander, Henry; Anderson, F. H.; Angus, H. F.; Bailey, A. G.; Bladen, V. W.; Brady, Alexander; Brown, G. W.; Clark, S. D.; Collin, W. E.; Daniells, Roy; Denomy, A. J.; Elliott, G. A.; Fairley, Barker; Ferguson, G. V.; Fieldhouse, H. N.; Fowke, V. C.; Frye, Northrop; Getty, R. J.; Gilmour, G. P.; Goudge, T. A.; Hawthorn, H. B.; James, F. Cyril; Kirkconnell, Watson; Lamb, W. Kaye; MacGibbon, D. A.; MacKenzie, N. A. M.; Mackintosh, W. A.; Morton, W. L.; Muckle, J. T.; Phelps, A. L.; Raddall, T. H.; Rose, W. J.; Ross, M. M.; Rouillard, C. D.; Salmon, E. T.; Scott, F. R.; Scott, R. B. Y.; Sissons, C. B.; Soward, F. H.; Stacey, C. P.; Stanley, George E. G.; Surveyer, E. Fabre; Thomson, J. S.; Timlin, Mabel F.; Wilkinson, B.; Wilson, G. E.

SECTION III

Archibald, W. J.; Babbitt, J. D.; Baer, Erich; Beals, C. S.; Bell, R. E.; Campbell, W. B.; Carmichael, Hugh; Currie, B. W.; Davies, F. T.; Demers, Pierre; Duckworth, H. E.; Field, G. S.; Foster, J. S.; Gagnon, P. E.; Gilchrist, Lachlan; Hachey, H. B.; Halperin, I.; Haslam, R. N. H.; Henderson, J. T.; Henderson, W. J.; Howlett, L. E.; Hurst, D. G.; Jones, R. N.; Katz, Leon; Kulka, M.; Laurence, G. C.; LeRoy, D. J.; Lossing, F. P.; Maass, Otto; Macphail, M. S.; Marshall, J. S.; Mason, S. G.; McLay, A. B.; Middleton, W. E. K.; Misener, A. D.; Morrison, J. A.; Niven, C. D.; Parkin, J. H.; Patterson, G. N.; Risi, Joseph; Robinson, G. de B.; Robson, J. M.; Rose, D. C.; Sargent, B. W.; Scherk, Peter; Shaw, A. Norman; Shrum, G. M.; Smith, H. Grayson; Steacie, E. W. R.; Thomson, Andrew; Walker, O. J.; Watson, W. H.; Williams, W. L. G.; Woonton, G. A.; Wright, G. F.; Zassenhaus, Hans; Gray, J. A. (retired)

SECTION IV

Alcock, F. J.; Berry, L. G.; Bostock, H. S.; Byers, A. R.; Campbell, Neil; Denis, B. T.; Douglas, G. V.; Folinsbee, R. E.; Fortier, Y. O.;

Fraser, H. J.; Gill, J. E.; Gunning, H. C.; Gussow, W. C.; Hawley, J. E.; Henderson, J. F.; Hewitt, D. F.; Hume, G. S.; James, W. F.; Jones, I. W.; Lang, A. H.; Legget, R. F.; Mawdsley, J. B.; Moore, E. S.; Osborne, F. F.; Riddell, J. E.; Russell, L. S.; Stevenson, J. S.; Tanton, T. L.; Warren, H. V.; Weeks, L. J.; Williams, M. Y.; Graham, R. P. D. (retired)

Section V

Bailey, D. L.; Bernard, Richard; Berrill, N. J.; Black, E. C.; Cameron, T. W. M.; Campbell, W. R.; Cantero, Antonio; Collip, J. B.; Cook, W. H.; Craigie, E. Horne; Craigie, J. H.; Dauphinee, J. A.; Daviault, Lionel; Drayton, F. L.; Duff, G. Lyman; Dunbar, M. J.; Dymond, J. R.; Eagles, Blythe; Ettinger, G. H.; Fisher, K. C.; Frappier, Armand; Gibbs, R. D.; Gibbons, N. E.; Grace, N. H.; Groves, J. W.; Jaques, L. B.; Lochhead, A. G.; MacIntosh, F. C.; Maheux, Georges; Murray, E. G. D.; Neatby, K. W.; Newton, Margaret; Pagé, E.; Préfontaine, Georges; Quastel, J. H.; Rawson, D. S.; Raymond, Marcel; Rempel, J. G.; Rousseau, Jacques; Rowan, William; Scott, D. A.; Shaner, R. F.; Thompson, W. P.; Thomson, D. L.; Venning, Eleanor H.; Young, E. Gordon.

The meeting was called to order by the President, Dr. G. S. Hume, who welcomed the Fellows and their guests and expressed the gratitude of the Society to the University of Montreal for its generosity in playing host to the Society. Mgr Irénée Lussier, Recteur de l'Université de Montréal, welcomed the Fellows in the following words:

Monsieur le Président, Membres de la Société Royale du Canada:

Depuis une semaine, l'Université voit passer en ses murs des savants de toutes les spécialités du savoir. Nous sommes très heureux que ces diverses réunions se tiennent chez nous.

Parmi toutes les sociétés qui nous font l'honneur d'avoir élu domicile en notre maison, il en est une—la vôtre—qui par la réputation qui est sienne et par le prestige s'attachant au nom de ceux qui en font partie fait, comme son nom l'indique, figure de reine. C'est pourquoi nous sommes particulièrement honorés de vous accueillir.

Merci d'avoir accepté notre hospitalité. Je fais des souhaits pour que vos réunions aient le plus complet succès et marquent un pas vers des progrès toujours plus grands et des réalisations toujours plus brillantes.

I want each and everyone of you to feel most heartily welcome at the Université de Montréal.

The President thanked Mgr Lussier.

The President called for a motion to approve the minutes of the last Annual Meeting. It was moved by Col. C. P. Stacey, seconded by Dr. W. Kaye Lamb, that the minutes be approved. Carried.

The election of twenty-six new Fellows, as listed in the Report of Council, was moved by Dr. H. S. M. Coxeter, seconded by Dr. J. B. Mawdsley.

CARRIED: L.-P. Audet, Marcel Faribault, Maurice Lamontagne, Jean-Jacques Lefebvre, Section I; R. J. Getty, G. P. Gilmour, E. H. Gilson, H. B. Hawthorn, W. L. Morton, C. D. Rouillard, Section II; E. Baer, F. P. Lossing, G. N. Patterson, J. M. Robson, G. F. Wright, H. Zassenhaus, Section III; R. E. Folinsbee, D. F. Hewitt, R. F. Legget, J. E. Riddell, Section IV; R. Bernard, E. C. Black, C. S. Hanes, F. C. MacIntosh, J. G. Rempel, W. E. Ricker, Section V.

Those present were formally presented to the President of the Society by the presidents of the Sections. They received diplomas and signed the Charter Book. Dr. E. H. Gilson, Section II, Dr. C. S. Hanes, Section V, and Dr. W. E. Ricker, Section V were absent. Dr. John S. Stevenson, Section IV, who had been elected in 1949, and Jean-Charles Bonenfant, Section I, elected in 1954, received diplomas and signed the Charter Book.

The Honorary Secretary presented the Report of Council and stated that he had nothing to add to that which was found in the report. He referred it to the Sections for approval.

The President invited Dr. G. W. Brown to present the recommendations concerning publication policy which had been approved by Council at its meeting on June 10th since it was felt that the various sections of the Society should be made aware of these recommendations and of the change that is taking place this year as an experiment.

Dr. Brown mentioned that for some time the publication policy of the Royal Society of Canada had been under discussion. He mentioned also that the *Transactions* as published in the past have not been entirely suitable and adequate to the needs of the Society.

The recommendations are: That in the current year, in addition to the *Transactions*, a specially edited volume be published which would go to all Fellows of the Society and be available for general sale. The volume should contain papers of broad interest which will reflect the character and aims of the Society; that suitable material may be drawn from the programmes of the Sections, provided the consent of individual authors is obtained; that the editor shall be free to obtain other papers if necessary to round out the contents of the volume along the lines desired; that this volume shall be in the nature of an experiment; that a special editor for the volume be appointed, that the Council underwrite the cost of the volume including an honorarium to the editor of $1200.

Dr. Brown reported that Dr. E. G. D. Murray has consented to edit this volume. Dr. Murray and Dr. Brown will be in touch with the Editorial Committees of the various sections so that plans may be made for the publication of this volume.

The President read a message received from Dr. J. B. Tyrrell's nurse in which she mentioned that owing to illness Dr. Tyrrell would be unable to attend the meetings in Montreal.

Dr. Hume gave a short biography of Dr. Tyrrell and stated that he was the oldest member of the Society, having been elected in 1910.

The President then asked the meeting to authorize the Honorary Secretary to send a message of greetings to Dr. Tyrrell. APPROVED.

The meeting was adjourned at 11 A.M.

Sectional meetings were held on the 11th, 12th, and 13th of June.

On Tuesday afternoon, at 5.30 P.M. the City of Montreal entertained the Fellows, their wives, and visitors at a reception held at the "Chalet de la Montagne." A reception by the University of Montreal was held Wednesday, June 13th for the Fellows and their wives.

Informal entertainment was provided by most of the Sections for their members.

The Second General Meeting of the Society was held at 3 P.M., Wednesday, June 13th.

It was moved by Dr. W. A. Mackintosh, seconded by Dr. Georges Maheux, that the Report of Council be adopted. CARRIED.

The Report of the General Nominating Committee was read by Col. C. P. Stacey, who moved, seconded by M. Pierre Dansereau, that the report be adopted. CARRIED.

The Society was greatly honoured by the presence of His Eminence Cardinal Paul-Emile Léger who welcomed the Society. His Eminence Cardinal Léger stated that the City of Montreal was very happy to offer hospitality to such an illustrious Society, and that the Université de Montréal was indeed very proud to be our host "et s'honore de vous posséder pendant quelques heures."

The President thanked His Eminence Cardinal Léger for his visit and expressed the deep appreciation of the Society.

Dr. G. S. Hume offered his sincere thanks to the members of Council for their co-operation, to Dr. J. T. Henderson for his excellent work as Honorary Treasurer, to Dr. W. Kaye Lamb for devoting so much time to the Canadian Government Overseas Awards, to Mrs. Métivier and the Ottawa staff for the good work done in connection with the annual meeting and to all those who had been closely associated with him in the past year. He stated that it had been a great pleasure as well as an honour for him to act as President of the Royal Society of Canada.

Dr. W. A. Mackintosh took the Chair and expressed his humble appreciation of the honour which the Society had paid him in electing him to the Presidency.

Reports were then received from the Sections. It was moved by Dr. J. T. Henderson, seconded by Dr. L. C. Simard, that the accounts of the Royal Society be audited again next year by the firm of J. B. Watson, chartered accountants. CARRIED.

A motion of thanks to the outgoing President and Council for the excellent way in which they had conducted the affairs of the Society in 1955-56 was made by Dr. M. Y. Williams, seconded by Dr. H. F. Angus. CARRIED.

Dr. A. Plouffe, seconded by M. Jean-Charles Falardeau, moved a vote of sincere thanks to Mgr Irénée Lussier, Recteur de l'Université de Montréal, and to the Board of Governors for their kindness in affording the Society the facilities of the University for this meeting and for the sumptuous reception offered by the University of Montreal to the Fellows and their wives. CARRIED.

Other motions of thanks were:

To McGill University for its hospitality in providing such excellent accommodation for the Fellows of the Society in the residences. Moved by Dr. J. B. Mawdsley, seconded by Dr. W. H. Watson. CARRIED.

To the City of Montreal for the excellent reception provided on Tuesday evening. Moved by Dr. I. W. Jones, seconded by Dr. D. C. Rose. CARRIED.

To the Local Committees for their co-operation in arranging all matters pertaining to the meetings. Moved by Dr. Paul E. Gagnon, seconded by Prof. V. W. Bladen. CARRIED.

To the members of the Press for their very good coverage of the meeting. Moved by Dr. W. Kaye Lamb, seconded by Dr. A. D. Misener. CARRIED.

It was agreed to accept Rev. Father Normandin's cordial invitation to hold the next meeting at the University of Ottawa.

The meeting was adjourned at 4.30 P.M.

PRESENTATION OF MEDALS

Médaille Pierre-Chauveau

Victor Morin

Monsieur le Président:

J'ai l'honneur de présenter, pour la Médaille Pierre-Chauveau, M. Victor Morin, membre de la Société royale du Canada depuis 1916, président de la Section des Humanités et des Sciences sociales en 1919-1920 et président général de la Société royale du Canada en 1938-1939.

M. Victor Morin est membre fondateur de la Société des Dix. Il fut, de 1921 à 1925, président de la Section française de l'Association des Auteurs canadiens, puis directeur de l'Alliance Française durant quarante ans.

Travailleur infatigable, il a publié nombre de livres et brochures traitant les sujets les plus variés, tantôt graves et tantôt légers. Il s'est particulièrement intéressé aux recherches historiques, et sa plume féconde a transmis fidèlement au public le fruit de ce travail persévérant.

Un grand nombre de revues importantes ont été heureuses de le compter parmi leurs collaborateurs.

Ecrire ne suffit pas à M. Morin. C'est avec une grande générosité qu'il met son talent d'organisateur et son expérience toujours croissante au service des organisations littéraires, historiques, artistiques, sociales et nationales.

Ces activités d'ordre intellectuel ne l'ont pas empêché de jouer un rôle de premier plan au sein de sa profession: le Notariat.

Il fut longtemps professeur à la faculté de Droit de l'Université de Montréal et apporta une participation active au travail de plusieurs commissions juridiques chargées de tâches difficiles.

Président de la Société St-Jean-Baptiste de Montréal durant neuf ans, il fut l'inspirateur et le réalisateur de nombreuses oeuvres et entreprises d'un caractère national.

Bref, M. Victor Morin est une preuve bien vivante de ce que le travail ne fait pas mourir, puisque, né en 1865, à St-Hyacinthe, il s'achemine allègrement vers l'étape du centenaire, en continuant de travailler au service de la société canadienne, dont il fut toujours un serviteur dévoué, utile et sympathique.

Eugène L'Heureux

Flavelle Medal

George Lyman Duff

Mr. President:

I have the honour to present to you, for the Flavelle Medal, George Lyman Duff, Dean of the Faculty of Medicine, and Director of the Pathological Institute, McGill University.

Dean Duff's career has been entirely devoted to scientific research and education. He has contributed largely to the advancement of science and to the welfare of humanity.

Born in Hamilton in 1904, he graduated with honours in Biology at the University of Toronto, received an M.D. degree with the David Dunlap Memorial Prize in 1929, and a Ph.D. in Pathology, with the Starr Gold Medal, in 1932, from the same University.

He was on the teaching staff of the Johns Hopkins University from 1931 to 1935; Assistant Professor of Pathology at the University of Toronto from 1935 to 1939; and Strathcona Professor of Pathology and Director of the Pathological Institute, McGill University since 1939. Appointed Dean of the McGill Faculty of Medicine in 1949, he has maintained his scientific work with the same energy, the same talent, the same proficiency, in the field of human pathology, despite the administrative burden placed upon his shoulders.

From the impressive list of his publications it is evident that his curiosity was focused on two main subjects, namely arteriosclerosis and diabetes. Among his outstanding contributions to the pathological literature is the chapter on the musculo-skeletal system which he wrote for the book entitled *The Collagen Diseases,* published in 1952.

Dean Duff's leadership and scientific prestige have brought him numerous honours and responsibilities in Canada, the United States, and abroad. He was elected president of the International Academy of Pathology in 1950.

Our distinguished colleague is consulting pathologist to eight Montreal hospitals as well as member of many editorial boards and various committees attached to national research institutions.

Enjoying an enviable reputation in international scientific circles, he has been an excellent ambassador of Canada and a brilliant representative of the Royal Society of Canada, to which he was elected in 1947.

Mr. President, I commend to you George Lyman Duff as a most worthy recipient of the Flavelle Medal and on behalf of Section V, I take great pleasure in offering him our heartfelt congratulations.

GEORGES MAHEUX

LORNE PIERCE MEDAL

Thomas Head Raddall

MR. PRESIDENT:

I present to you Thomas Head Raddall for the award of the Lorne Pierce Medal in recognition of his distinction as a novelist, as a writer of stories, and as a historian. The late Professor Archibald McMechan, of treasured memory, maintained that the most remarkable thing about Nova Scotia was its Nova Scotia-ness. Its peninsular character is much more than a matter of geography; united to Canada, Nova Scotia continues to remain

apart but not aloof in its habitation by the sea. A land whose frontier is the illimitable Atlantic Ocean cannot be adequately described as another Canadian province. Rather, the people of Nova Scotia have turned provinciality itself into the distinctiveness of a unique race that gives them a quality of their very own. This is the spell that has laid its enchantment on Mr. Raddall, giving wings to his imagination and inspiration to his hand. Sometimes an adopted child enters more deeply than native sons into the love and lore of an ancestral home, and in our author, Nova Scotia has gained just such a devotee—albeit, the latest of a long line of adventurers cast away on these ultimate shores to find it much more than a place in which to dwell. To the *genius loci* of Nova Scotia he has been a willing slave: his is the pen of the readiest of writers. Story after story, tale after tale have flowed from his fertile imagination drawing from that most ancient of sources—the sea and the adventures of men who do business in its great waters. With the fresh vigour of new inspiration he has exercised himself in the oldest of the arts, delighting the mind by the revival of heroic history, writing of things elemental and courageous to fire the heart in another and very different day.

It would be as tedious as it is unnecessary to begin here any recital of his works. Already his name and fame are fully established in the world of contemporary writing not only here in Canada, but in many lands. He has built and launched a vast and varied armada of literary craft to carry his merchandise into far harbours. Novels, short stories, literary articles, historical memoirs have appeared in sustained succession from his pen. We honour him as an authentic Canadian writer, adding this accolade of the Lorne Pierce Medal to honours and recognitions that have already acclaimed his capacity and his power.

JAMES S. THOMSON

TYRRELL MEDAL

Mgr Olivier Maurault

MONSIEUR LE PRÉSIDENT :

C'est un grand honneur que de vous présenter le titulaire de la médaille Tyrrell 1956: Monseigneur Jean-Léon Olivier Maurault, p.s.s. qui présida, à titre de Recteur, aux destinées de l'Université de Montréal pendant vingt et un ans.

Notre récipiendaire est bien connu de ses confrères de la Société royale dont il est membre depuis vingt-cinq ans, dont il fut président de la Section française, puis président général en 1944.

Retracer toutes les activités scientifiques et littéraires de Mgr Maurault, faire état des nombreuses distinctions dont il a été l'objet dépasserait très largement le cadre de cette présentation. Que Monseigneur et cet auditoire distingué m'excuse de ne pas présenter un palmarès fort imposant d'activités toutes au service des nobles causes de l'apostolat et de l'éducation.

La Section française, désireuse de couronner l'ensemble de son œuvre abondante, veut reconnaître en lui l'historien de Montréal et de ses origines, de la compagnie de Saint-Sulpice dont il est l'un des fils les plus distingués, l'esthète raffiné dont plusieurs écrits ont la qualité de pierres précieuses finement taillées.

S'il est permis de porter un jugement sur son œuvre écrite et son action, car les deux sont solidaires l'une de l'autre, personne ne peut contester que notre distingué confrère soit l'un des précurseurs du mouvement artistique de la métropole. Nombreux sont ceux qu'il a aidés, orientés vers des carrières à peu près inconnues chez nous, voici trente-cinq ans.

N'a-t-il pas été l'instigateur de ces premières expositions artistiques à la Bibliothèque Saint-Sulpice, le préfacier de nos premiers ouvrages sur l'art canadien, l'avant-gardiste toujours attentif à toutes les disciplines d'ordre culturel. Orateur et prédicateur à l'éloquence chaude, prenante et d'une haute distinction, la paroisse Saint-Jacques s'en souvient et ceux de Notre Dame aussi, il nous a maintes fois représenté dans les deux Amériques et en Europe avec les qualités, l'âme et le cœur de conquérants.

Durant toute sa carrière, Mgr Olivier Maurault fait figure d'un précurseur qui n'a pas en vain prêché dans le désert, si l'on considère les progrès de notre marche dans "les sentiers de la culture" pour rappeler le titre de l'ouvrage de notre confrère S. Ex. Jean Désy.

Aussi le comité a-t-il été étonné de constater, en proposant Mgr Maurault à la médaille Tyrrell, que jamais encore, la Société royale qu'il a si dignement servi, n'avait songé à souligner ses mérites comme elle le fait ce soir. Mais "mieux vaut tard que jamais." Monsieur le Président, j'ai l'insigne honneur de vous présenter Mgr Olivier Maurault, prêtre de Saint-Sulpice, protonotaire apostolique, chevalier de l'Ordre de Saint Michel et de Saint Georges, docteur *honoris causa* de nombreuses universités canadiennes et étrangères, orateur et écrivain doublé d'une âme d'apôtre et par-dessus tout, la personnification la plus authentique de notre gentilhommerie canadienne d'expression française.

JEAN-MARIE GAUVREAU

REPORTS OF SECTIONS

Rapport de la Section I

La Section I a tenu quatre réunions auxquelles ont assisté vingt-trois sociétaires: MM. Louis Philippe Audet, Jean-Charles Bonenfant, Georges Bouchard, Jean Bruchési, Mlle Cécile Chabot, MM. Pierre Daviault, Robert Elie, Jean-Charles Falardeau, Marcel Faribault, Donatien Frémont, Jean-Marie Gauvreau, Maurice Lamontagne, Gustave Lanctot, Maurice Lebel, Jean-Jacques Lefebvre, Eugène l'Heureux, Léon Lortie, Mgr Olivier Maurault, Claude Melançon, Victor Morin, Gérard Morisset, Antoine Roy et Adrien Plouffe. Plusieurs visiteurs nous ont honorés de leur présence.

La Section I a consacré une séance à la discussion des affaires courantes. Après avoir entendu un message spécial du président, M. Eugène L'Heureux, la Section I a pris connaissance en tout ou en partie de quatorze communications. Avec les Sections II et V, elle a participé au Symposium sur l'importance des langues étrangères pour l'avancement de la littérature et des sciences.

Nous avons accueilli ensuite quatre nouveaux sociétaires: MM. Louis-Philippe Audet, Marcel Faribault, Maurice Lamontagne et Jean-Jacques Lefebvre.

Les élections ont donné les résultats suivants:

Président: M. Jean-Marie Gauvreau
Vice-président: M. Harry Bernard
Secrétaire: M. Adrien Plouffe
Représentant supplémentaire au Conseil: M. Maurice Lebel
Comité de lecture: MM. Pierre Daviault, Adrien Plouffe, Léon Lorrain, Donatien Frémont
Comité de la médaille Chauveau: MM. Jean-Marie Gauvreau, Pierre Daviault, Robert Elie, Léon Lortie, Harry Bernard
Comité de la médaille Lorne Pierce: MM. Robert Elie, Harry Bernard, Antoine Roy
Comité de la médaille Tyrrell: MM. Harry Bernard, Jean Bruchési, Antoine Roy
Comité de nominations: MM. Jean-Marie Gauvreau, Adrien Plouffe
Comité de candidatures: Président, M. Jean-Marie Gauvreau; MM. Harry Bernard, Adrien Plouffe, Léon Lorrain, Jean-Charles Bonenfant, Pierre Daviault, Gérard Morisset
Comité des bourses: Président, M. Maurice Lebel; MM. Jean Bruchési, le R. P. Louis-Marie Régis, le R. P. Georges-Henri Lévesque, Jean Vallerand
Comité du programme: Président, M. Léon Lortie; MM. Jean-Charles Falardeau, Adrien Plouffe
L'Editeur: M. Adrien Plouffe

Il est proposé par Adrien Plouffe, appuyé par Léon Lortie, que le rapport de la Section I soit adopté.

Report of Section II

Section II held two business meetings, two general sessions, one joint session with Sections I and V and two round table sessions. Forty-nine Fellows attended and there were many visitors. The joint session with Sections I and V on "Foreign Languages and the Progress of Literature and the Sciences" was particularly successful.

The following officers were elected:

President: W. Kaye Lamb
Vice-President: F. H. Underhill
Secretary: S. D. Clark
Additional Member of Council: B. S. Keirstead
Editorial Committee: B. S. Keirstead, S. D. Clark, Hugh MacLennan, W. L. Morton
Selection Committee: F. H. Underhill *(Ch.)*, W. Kaye Lamb, S. D. Clark, V. C. Fowke, T. A. Goudge, Malcolm Ross
Representatives on the Lorne Pierce Medal Committee: W. Kaye Lamb, F. H. Underhill, W. C. D. Pacey
Representatives on the Tyrrell Medal Committee: W. Kaye Lamb, F. H. Underhill, J. A. Corry
Scholarship Committee: F. E. L. Priestley *(Chairman)*, W. Kaye Lamb, F. H. Underhill
Programme Committee: B. S. Keirstead *(Chairman)*, S. D. Clark, Hugh MacLennan, W. L. Morton
Representatives on General Nominating Committee: F. H. Soward, F. A. Knox

The Report of Council was approved.

The Section noted with deep regret the deaths of Skuli Johnson, C. W. Colby, and W. C. Graham.

The Section noted the transfer to the retired list of D. Jenness, W. H. Alexander, and R. C. Lodge.

It was moved by S. D. Clark, seconded by W. Kaye Lamb, that this report be adopted.

Report of Section III

This year the Section held thirteen scientific sessions and two business meetings.

The Section welcomed its 6 new Fellows:

Dr. Erich Baer	Professor and Head of Sub-Department of Synthetic Chemistry in relation to Medical Research at the Banting Institute, Toronto

Dr. F. P. Lossing	Senior Research Officer (in charge of Mass Spectroscopy Section), National Research Council
Dr. G. N. Patterson	Director of the Institute of Aerophysics, Professor of Aeronautical Engineering in the University of Toronto
Mr. John M. Robson	Nuclear physicist, Atomic Energy of Canada, Chalk River
Dr. George F. Wright	Professor of Organic Chemistry in the University of Toronto
Dr. Hans Zassenhaus	Professor of Mathematics, McGill University, Montreal

The Section noted with deep regret the death of three of its members —John Patterson, E. L. Harrington, and Louis V. King, F.R.S.—and paid a silent tribute to their memory.

The Section formally accepted the report of Council, and expressed its approval in principle of the new policy reported by the Publications Committee.

The following officers and committee members were elected:

President: H. S. M. COXETER
Vice-President: LÉO MARION
Secretary: A. D. MISENER
Additional Member of Council: W. H. WATSON
Editorial Committee: D. A. KEYS *(Chairman)*, T. THORVALDSON, G. DE B. ROBINSON
Nominating Committee: H. S. M. COXETER, LÉO MARION
Tory Medal Committee: OTTO MAASS *(Convener)*, J. S. FOSTER, T. THORVALDSON, G. HERZBERG, E. W. R. STEACIE
Committee for Selection of New Fellows: D. J. LEROY *(Chairman)*, A. MCKELLAR, D. C. ROSE, Officers of the Section
Scholarship Committee: C. S. BEALS *(Chairman)*, R. L. JEFFERY, P. GIGUERE, B. W. CURRIE
Programme Committee: A. D. MISENER *(Chairman)*, H. S. M. COXETER, J. S. MARSHALL, G. DE B. ROBINSON, W. H. WATSON, LÉO MARION
Representatives on the International Astronomical Union: HELEN S. HOGG, B. W. CURRIE, ANDREW THOMSON
Representatives on the Editorial Board, Canadian Journals of Research: H. E. DUCKWORTH, T. THORVALDSON
Representative on the C.I.C. Medal Committee: H. G. THODE
Representative on the Canadian National Committee of the International Union of Pure and Applied Chemistry: J. W. T. SPINKS
Representative on the Canadian National Committee of the International Union of Pure and Applied Physics: A. D. MISENER

The attendance at the sessions was excellent. Of the 106 papers on the programme, 103 were actually presented. The Presidential Address, entitled "Perspectives towards the Future in Physics," was the most provocative and stimulating paper delivered before the Section.

Report of Section IV

Section IV held five sessions, including one business session and two symposia, one "On the Proterozoic in Canada," and one held jointly with the Committee on Oceanography on "The Ocean Floors around Canada." The sessions were attended by 35 Fellows and guests.

The Section notes with deep regret the deaths of four of its Fellows: W. E. Cockfield, H. C. Cooke, T. C. Denis, and R. Rose.

Four new Fellows, R. E. Folinsbee, D. F. Hewitt, R. F. Legget, and J. E. Riddell were elected and presented to the Society.

The following officers and representatives were elected for the Section for 1956-57:

President: H. C. Gunning
Vice-President: H. C. Rickaby
Secretary: H. S. Bostock
Additional Member of Council: J. E. Hawley
Editorial Committee: H. C. Gunning *(Chairman)*, H. S. Bostock and other members to be chosen from the Fellows in Vancouver
General Nominating Committee: J. E. Hawley, J. E. Gill
The Willet G. Miller Medal Committee (appointed last year and stands for the selection of the medallist for 1957): L. S. Russell *(Chairman)*, A. E. Wilson, F. F. Osborne, A. R. Byers, and J. S. Stevenson
Advisory Committee for new Fellows: L. G. Berry *(Chairman)*, V. J. Okulitch, D. R. Derry, J. S. Stevenson, G. V. Douglas, G. M. Brownell, H. S. Bostock
Scholarship Committee: E. S. Moore *(Chairman)*, H. J. Fraser, I. W. Jones
Programme Committee: J. T. Wilson *(Chairman)*, J. E. Gill, J. E. Hawley

The acceptance of W. J. Wright's request to be placed on the retired list is recommended to Council.

The Section accepts the Report of Council.

It was moved by H. S. Bostock, seconded by J. E. Gill that this report be accepted.

Report of Section V

A large number of Fellows and guests, 71 at the first session, were in attendance and 42 papers were presented.

The Section held two business meetings. It met as a whole on Monday afternoon for the President's address by Dr. G. Maheux who spoke on conservation and the challenge this great subject presents to biologists. Three papers of general interest were also given. On Tuesday morning the Section joined with Sections I and II in an interesting and enlightening panel discussion on "Foreign Languages and the Progress of Literature and the Sciences." The Section then divided into sub-sections on Medical Sciences and Biological Sciences Tuesday afternoon and Wednesday morning, with a final combined session Wednesday afternoon.

The Section welcomed six new members, approved the report of Council and approved with regret the transfer of Dr. J. C. Meakins to the retired list. The Section noted with regret the deaths of Dr. A. J. Cipriani, Dr. F. J. Lewis, Dr. J. M. Swaine and Dr. E. W. MacBride. The committee appointed at the request of Council to consider the Harrison bequest has now completed its task of formulating principles and regulations. The award is to be known as the Harrison Prize of the Royal Society and will be made every three years. In accordance with the provisions of the bequest, the President of Section V has named a committee of three to make the selection. Members are A. G. Lockhead (Chairman), Blythe Eagles, and W. H. Cook.

Last year the Section appointed a committee to study the question of support of Biological Research and Education; their report was presented as a symposium of four papers. This report was duly considered by the Section and a precis thereof follows herewith:

The Section endorses the principle that all graduate scholarships should be for a period of twelve months, with provision for an additional four months term, during the initial or final period of study; that each such scholarship should have attached to it a sum equivalent to half its value, for the pertinent expenses of the laboratory in which the student is working; and that all research grants should be on a continuing basis and should be assured, if desired, for a minimum of three years.

The Section encourages agencies which dispense funds for highly specialized research, such as, for example, on heart disease, to devote a portion of the funds available to strictly fundamental biological research without regard to the specialized field. Section V offers its services in the allocation of such funds.

The necessity for greater support of fundamental non-medical biological research should be emphasized to both governmental and industrial agencies. In this connection, the Section favors the establishment of research professorships or similar positions by industry and governmental agencies, these to be similar to the medical research associates, recently established by the National Research Council.

The Section requests that the Editorial Committee put back the date for submission of papers by the Section Editor as late as reasonably possible. The Section approved the appointment of a standing Committee on Programming, to select topics for discussion by the Section at the Annual Meeting and to provide a continued and balanced policy of selecting such subjects. The work of this committee will be co-ordinated with that of the

local programme committee which would be responsible for local details. The Section decided that for 1957—the 75th anniversary year—papers would be presented by Fellows only.

The following officers and committee members were elected for the 1956-57 session:

President: W. H. Cook
Vice-President: W. R. Campbell
Secretary: N. H. Grace
Additional Member of Council: G. Maheux
Editorial Committee: E. Horne Craigie, H. B. Sifton, A. Frappier
Medal Committee, Flavelle Medal: To retire in 1957, G. H. Ettinger, L. Daviault, J. L. Hart; To retire in 1958, R. F. Shaner, J. A. Dauphinee *(Chairman)*, M. W. Bannan
General Nominating Committee: W. P. Thompson, A. G. Huntsman
Selection Committee: To retire in 1957, F. R. Hayes *(Chairman)* G. Krotkov; To retire in 1958, W. R. Campbell, P. Dansereau; To retire in 1959, I. McT. Cowan, K. Fisher, and the Secretary
Scholarship Committee: D. L. Thompson *(Chairman)*, R. Pomerleau, B. Eagles, R. J. Rossiter
Programme Committee: C. A. Mitchell *(Chairman)*, N. E. Gibbons, J. W. Groves (with power to add)
Representatives on Editorial Board, Canadian Journals of Research: D. L. Bailey, T. W. M. Cameron

APPENDIX A

DISCOURS PRÉSIDENTIEL
PRESIDENTIAL ADDRESS

PROCEEDINGS OF THE ROYAL SOCIETY OF CANADA
VOLUME L : SERIES III : JUNE, 1956

DISCOURS PRÉSIDENTIEL PRESIDENTIAL ADDRESS

The Foothills and Eastern Rocky Mountains of Southern Canada

G. S. HUME, F.R.S.C.

THERE are few more fascinating problems in geology than those related to the origin of mountains. Mountains as ordinarily seen are commonly viewed from the elevated lands surrounding them, or in certain localities from the level of the sea. Even then they may be impressive but their grandeur in many cases would be greatly enhanced could they be viewed from the sea floor which may slope precipitously from the shore to abysmal depths.

Many years ago it was noted that mountain chains commonly bordered the continents and this is particularly true of North America. In the eastern United States the Appalachians border the Atlantic Ocean. On the western continental border are the ranges comprising the Cordillera. It is known that the highest mountain ranges are likely to be young geologically. The Appalachians on the east side of North America are much older geologically than the Cordillera of the west coast. Within the Cordillera there are, in a general way, progressively younger mountains from west to east. This, of course, means that the Coast Range and associated mountains originated first and that the Rocky Mountains, separated from the Coast Range by the interior plateaux and related mountains, were elevated later by forces with a strong eastward component of thrust.

No sooner is a land mass raised above sea level than it becomes subjected to the tremendous forces of erosion. The rate of erosion, assuming other factors to be the same, would be much faster on a highly elevated mass than on a less elevated one. Thus a mountain that is not rejuvenated by repeated new uplifts may in a relatively moderate time, as measured geologically, be reduced to base level. This may in part explain why the older Appalachians are more subdued topographically than the Cordillera but there may be other reasons. It is quite apparent, therefore, that given sufficient time, mountains may totally disappear as topographic features from the earth's surface. However, the roots of mountains as indicated by the structures, and by the character of the core material, will remain. There are many places in the Precambrian Shield,[1] which forms the more solid and resistant mass of this continent, where these appear. Rocks within the Precambrian Shield are the oldest known anywhere on this globe so it is

[1]J. E. Gill, Mountain Building in the Canadian Precambrian Shield; in 18th Internat. Geol. Congress, 1948, Pt. XIII, Sec. M (1952).

evident that throughout the geological evolution of this planet, and in particular of this continent, great masses have been uplifted into mountain ranges to become subjected to devastating forces of denudation produced by climatic conditions that tend to reduce them to base level.

The foothills and mountains of southern Alberta offer a unique locality in which to study the effects of these opposing geological forces. Rock exposures are sufficiently prevalent to make possible reasonably good geological interpretations of the structures produced by the mountain-building forces and in certain localities structural traps suitable for the accumulation and retention of large reservoirs of petroleum and natural gas have been formed. During the last few years the search for oil fields has been intense, and numerous wells, many of which exceed 10,000 feet in depth, have been drilled. Great riches have been revealed and although drilling depths are relatively slight in relation to the thickness of the earth's crust, yet they have been sufficient to provide valuable data regarding types of structures that previously have been inadequately understood. These superficial structures, therefore, become the basis for interpretations regarding deeper structures, which reveal the mechanisms of mountain-building processes.

Erosion has played a significant part in revealing the trends of the structural features within the foothills and mountains. The more resistant rocks have been left as mountain ridges and elongated hills, not because they were necessarily uplifted more than other parts, but because softer strata have been more susceptible to the forces of degradation and have been eroded to produce valleys. Thus in southern Alberta there is a succession of parallel ridges and valleys which for the most part trend northwesterly. As a result, the minor streams follow the structural trend of these valleys to join in major streams which cut almost directly across alternating bands of hard and soft rocks, thus producing picturesque waterfalls or rapids; some of these have become the sites of hydro-electric plants. The major streams obviously had their origin on an older plain gently sloping eastward and thus they are now superimposed on the present topography as it has been developed by erosion. The forces of uplift, therefore, elevated the mountains and foothills and the forces of erosion are now at work creating the present physical features. This, then, is the setting against which the geology of southern Alberta will be briefly considered in relation to rock structures. The correct interpretation of these structures is of major economic significance.

Thrust Faults

The McConnell Fault

The Rocky Mountains have one very striking structural feature in common with the foothills on their eastern margin; namely, the occurrence of thrust faults in which great or small slices of sedimentary rocks have been thrust over one another. The great thrust at the mountain front in the Bow River valley has been named the McConnell fault (Fig. 1).[2] It

[2]L. M. Clark, Geology of Rocky Mountain Front Ranges near Bow River, Alberta; in Amer. Assoc. Pet. Geol., Western Canada Sedimentary Basin, p. 5 (1954).

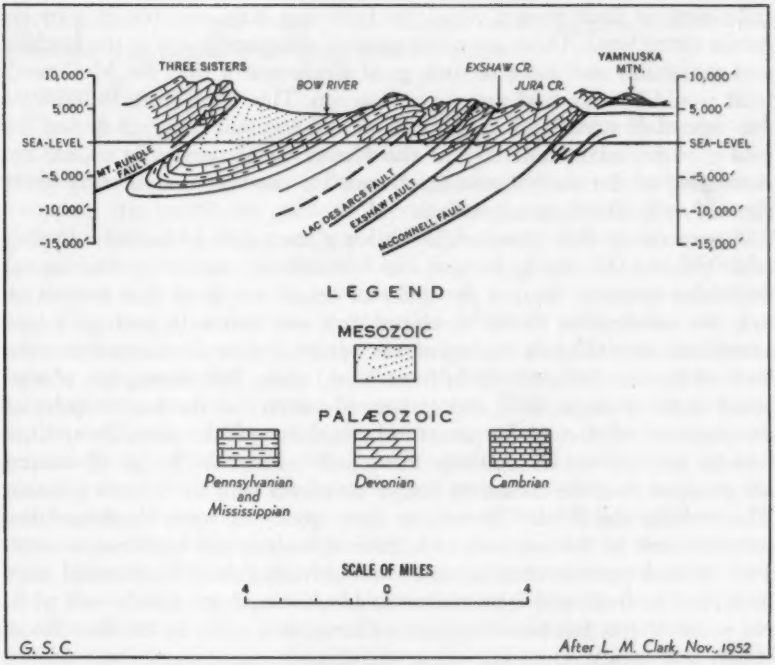


FIGURE 1. Cross-section of the front ranges of the Rocky Mountains in the vicinity of Bow River, Alberta.

is fitting that this should be described here because R. G. McConnell was not only a distinguished Canadian geologist but he was a Fellow of this Society from 1913 until his death in 1942. He was the first to observe this fault and describe its significance.[3] He recognized it as a great break in the earth's crust through which older rocks have overridden younger rocks, thus reversing the normal sequence. The fault in fact represents a shortening in the superficial part of the earth's crust brought about by compression which not only lifted the rocks *en masse* but broke them along and across their bedding planes. Palaeozoic limestones were thrust upwards and eastward and now overlie younger Cretaceous sandstones and shales.

The fault on its eastern margin is seen to be relatively flat. In the Bow River valley, however, it appears to have an inclination westward of about 45 degrees but flattens northward. If it continues downward at 45 degrees the Palaeozoic beds now forming the uppermost mountain mass were derived from almost four miles to the west and from a depth of 13,000 feet below the Mesozoic strata on which they rest. If the angle of inclination of the fault is more gentle at depth than where it can be observed, the beds derived from a similar depth may have originally been five to six or more

[3]R. G. McConnell, Report on the Geological Features of a Portion of the Rocky Mountains; in Geol. Surv., Canada, Annual Rept., vol. II (1886).

miles west of their present site. This fault is a large one but it is by no means exceptional. There are many more of comparable size in the foothills and mountains and some of such great displacement that the McConnell fault would be only moderate by comparison. This, then, tends to illustrate one type of structure and the gigantic movements that occurred during the course of mountain building. It also illustrates, as previously stated, the shortening of the earth's superficial crust by breaking and shoving great slices of rocks into mountain masses.

A traverse up Bow River valley shows a succession of westerly dipping fault blocks each resting on the one immediately east of it. The logical deduction seems to be that the order of origin was from east to west or that the easternmost blocks developed first and that with perhaps minor exceptions each block in succession westward was shoved eastward over the back of the one immediately in front (east) of it. This conception of supposed order of origin from east to west is contrary to the known order of development of the major structural provinces of the Cordillera, since without question the Coast Range developed first and the Rocky Mountains are younger than the mountain ranges associated with the interior plateau. Thus within the Rocky Mountains some geologists have challenged the point of view of development of individual fault blocks from east to west. They think it possible that, in some cases at least, a fault block could have developed in front and from under the block lying immediately west of it. No proof of this has been deduced so far from studies in the Bow River valley, but elsewhere, as will be shown, there is strong suggestive evidence that for some faults such an origin is probable. The problem of the order of origin should not be considered lightly as of academic interest only. Its proper solution is of great practical and economic significance in relation to the interpretation of oil and gas structures.

The McConnell fault block represents a relatively simple geological structure but there can be many complexities. The individual peaks of the Rocky Mountains, 8,000 to 12,000 feet or more in elevation, are composed mostly of limestones or dolomites relatively resistant to weathering in comparison with the soft sandstones and shales that compose the mountain valleys and a large part of the foothills. Also because of their more massive character they have in general been broken by faulting into large blocks whereas in the sandstones and shales of the foothills the faults, as observed at the surface, are commonly smaller and closer spaced. Experience in drilling, however, soon dispelled any ideas concerning the prevalence of only small faults in the foothills. Some whose surface displacement appeared rather small have been drilled at relatively moderate depths and they have proven to be exceedingly large. It seems quite apparent, therefore, that the steeper faults observed in the surface beds are derived at depth from a less steeply inclined fault plane on which the displacement is the accumulated amounts observed in the smaller surface faults. This, in effect, gives a sole fault and the imbricated structure here present is of a similar type to that in the Highlands of Scotland described many years

ago.[4] However, the sole faults in the Alberta foothills appear to have preceded the imbrications in the order of development.

Turner Valley Structure

There have been more than 500 wells drilled in the Turner Valley oil and gas field, a complicated structure on the eastern edge of the foothills. The productive zone is the same Palaeozoic (Mississippian) formation that comprises the uppermost part of Mount Rundle at Banff. The Turner Valley oil and gas field is twenty miles long by two to three miles wide and the producing beds are reached at 3,450 to more than 9,000 feet in depth, the deeper wells being on the western flank of the structure down the west dip. The vertical difference in elevation between wells drilled on the crest and one well drilled in the south end of the field on the flank, outside the producing area, is about 6,600 feet but this does not fully represent the relief of the limestone core. Thus, if the beds covering the limestone under Turner Valley were removed, a mountain mass in general form not unlike Mount Rundle would be revealed. This oil and gas field is therefore in reality a buried mountain with a fault on its eastern side of the same thrust type as that of the McConnell fault. In the process of uplift from an ancestral fold, the shoving of the limestone mass upward and forward has caused the eastern broken edges to drag along the fault plane producing an asymmetrical fold with steeply dipping or overturned east flank and a much more gently dipping west flank.

Now that the general structural features of Turner Valley are known and reasonably well understood it is not difficult to relate them by comparison to other mountain masses formed under similar conditions. In the period of intensive oil field development, however, following the first successful drilling, many interpretations were possible from the then known facts and all seemed equally plausible. The result was that quite a number of dry holes were drilled not only in Turner Valley but in other foothills areas where the structural features appeared as favourable for the occurrence of oil as in Turner Valley itself. One of these was the Highwood uplift (Fig. 2), which is separated from southern Turner Valley by the Outwest fault. In the Highwood structure, as predicted by geological studies, the possibly productive limestone mass rises to a higher elevation than in Turner Valley. No better structural prospect for oil could be imagined but it was soon proven by drilling that the producing zone was filled with salt water. It was therefore apparent that when the accumulation of oil and gas took place in the ancestral Turner Valley fold the Highwood limestone mass had not yet been broken by the Outwest fault and lay down the dip in a continuous formation far to the west of its present location. At that time it was water-filled and its prospective value was in no way altered by being faulted and uplifted even though in the process of favourable geological structure to contain oil was produced.

[4]Peach, Horne, Gunn, etc. The Geological Structure of the Northwest Highlands of Scotland; Geol. Surv., Gt. Br., Mem. 668 (1907).

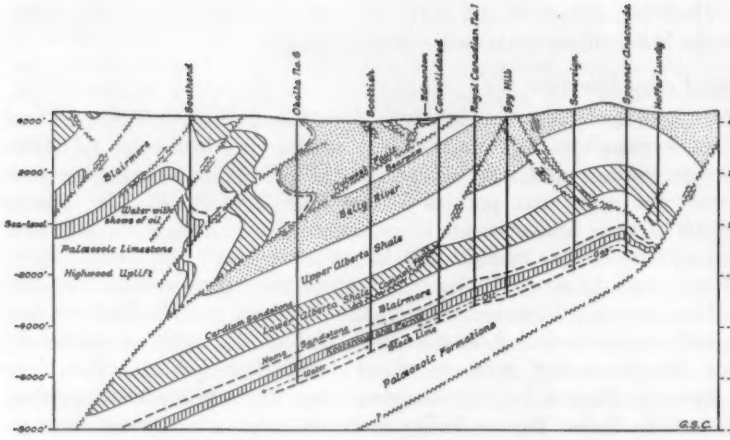


FIGURE 2. Cross-section of southern Turner Valley, Alberta.

The fact that the oil accumulation preceded faulting was further demonstrated in Turner Valley itself by a fault block on the east side in the north end of the field.[5] Ordinarily, in any field, oil is underlain by salt water and the oil-water line in any one structure is reasonably uniform in elevation throughout. In a fault block which originally was a part of the main mass of Turner Valley but now occurs at a lower level on the east side, oil occurred far below the ordinary elevation of the oil-water line of the main structure. This indicated that faulting had occurred subsequent to oil accumulation and as a result the east block with its oil content had been depressed relative to the main limestone mass.

These events in geological history have been stressed because they are of vital importance in assessing economic values prior to drilling. In the foothills many wells have cost upwards of a million dollars each and in some cases more than this. The character of the sedimentation, the ancestral warping, and subsequent events in mountain building are therefore events of great practical significance.

The Lewis Fault

The Lewis fault and overthrust sheet comprise the most remarkable geological feature of southwestern Alberta. The fault was first recognized and described in northern Montana but it is just as prominent in Canada.[6] In the vicinity of the international boundary at Waterton Park the fault

[5]G. S. Hume, Petroleum Geology of Canada, Ec. Geol. Series 14, p. 42 (1944). See also T. A. Link, History of Geological Interpretation of the Turner Valley Structure and Alberta Foothills, Canada; in 3rd Annual Field Conference, Alta. Soc. Pet. Geol., p. 132 (1953).

[6]Bailey Willis, Stratigraphy and Structure, Lewis and Livingstone Ranges, Montana; Geol. Soc. Amer., vol. 13, p. 305 (1902).

lies at the eastern base of the mountains which rise abruptly from the plains. The mountains themselves comprise the Clark Range in which the peaks are 3,000 to 4,000 or more feet above the valley levels. The whole of the mountain range, 20 miles wide, is the Lewis overthrust mass and it is bounded on the west by the Flathead Valley in British Columbia. The crest of the range is the interprovincial boundary.

The regional structure of the Clark Range consists of a trough-like fold or broad syncline but in detail there are many complexities. The rocks composing the range are late Precambrian in age overlain by younger Palaeozoic beds which in part, in the central area of the syncline, form the mountain peaks whereas on the east and west sides the peaks are wholly of the underlying Precambrian rocks. Most of the beds except in the vicinity of local disturbances have a relatively low inclination. In one locality, in a valley tributary to that of the Flathead river, there is, as shown by Clark,[7] a window through the fault plate where the beds under the fault plane have been exposed by erosion. Below the thrust plane strata of Mesozoic and Palaeozoic ages occur. These beds are, of course, younger than the Precambrian beds above the fault plane and are even younger than the Palaeozoic strata which form the peaks of the mountains of the Clark Range. Here then is a tremendous reversal of sequence of age of beds along the fault plane amounting to many thousands of feet with the older beds resting on those of younger ages. Without question the Lewis fault, which was responsible for this, passes under the twenty-mile wide regional syncline and for considerable distances may largely follow or be close to the bedding plane of one formation. It was undoubtedly folded with the syncline subsequent to thrusting. The total displacement on such a low angle fault is difficult to estimate but it would seem the whole mountain range has been moved from the southwest for a distance of perhaps fifteen miles and the amount has been estimated by one geologist to be as much as forty miles.[8]

It has also been pointed out that 175 miles to the east the top of the Cypress Hills area on the boundary of Alberta and Saskatchewan is covered by a resistant conglomerate formation in which there are boulders up to nine inches in diameter. The age of the formation, the composition of the boulders, and other evidence all point to an origin for the pebbles and boulders of the conglomerate in the mountains to the west. It seems apparent that this conglomerate owing to its resistance to erosion has been the factor that has caused the Cypress Hills to remain as a prominent feature of the landscape with a maximum elevation of slightly more than 4,800 feet. The boulders could hardly have been carried from the mountains for two hundred miles to the Cypress Hills except by streams in a

[7]L. M. Clark, Cross-Section through the Clark Range of the Rocky Mountains of Southern Alberta and Southern British Columbia; in Guide Book for 4th Annual Field Conference, Alta. Soc. Pet. Geol. (1954); map p. 106.

[8]R. A. Daly, Geology of the North American Cordillera at the 49th Parallel; in Geol. Surv., Canada, Mem. 38, p. 117 (1912).

valley opening onto a flood plain. The gradient could not have been less than 15 feet to the mile.[9] This then would mean that at a minimum the boulders must have been derived from valleys in mountains at least 2,500 to 3,000 feet above the level of the Cypress Hills unless, of course, there has subsequently been differential warping to account for the difference in elevation. The evidence for large regional uplift of the Cypress Hills area relative to the surrounding areas is not apparent and such an uplift may be dismissed as having no real bearing on the problem although some moderate differential movement may be present. Thus the hypothesis of origin of the boulders not only means derivation of streams in valleys in the mountains from an elevation of at least 7,500 feet but it means a continuous sloping surface from the mountains to the Cypress Hills over an area which now has an elevation on the plains at Medicine Hat, for example, of 2,600 to 2,700 feet. The minimum amount of erosion to reduce the plains to their present level at this place has been approximately 2,000 feet, the difference in height between the plains at Medicine Hat and the top of the Cypress Hills. In front of the mountains at Waterton the elevation of the plains is variable owing to the rolling nature of the topography but in general it is from 4,200 to 4,400 feet, sloping off to 4,000 feet at Cardston, twenty-five miles to the east. Thus the present terrain immediately in front of the mountains is lower than the top of Cypress Hills and at least 3,000 feet lower than it would have to be if streams carried pebbles from the front range of this area during the deposition of the Cypress Hills conglomerate.

The boulders of the Cypress Hills conglomerate have not been identified as belonging to any particular formation now exposed in the Rocky Mountains and there seem to be several possible sources. Precambrian rocks of a somewhat similar type outcrop in the United States south of the international boundary at considerably higher elevations than in any part of the Lewis thrust sheet in Canada. However, few mountains exceed 10,000 feet in elevation, and the valleys where they emerge from the mountains to join the plains are all considerably less than 6,000 feet in elevation. Thus much higher valleys sloping northeastward than are now present must have existed at the time of the deposition of the Cypress Hills conglomerate if the hypothesis of water transportation of pebbles and boulders from these mountains is correct.

Even if this area is ultimately proven not to be the source of the boulders the argument given here is still valid provided the main hypothesis is true, namely, that the source was originally from rock exposed within the mountains, as seems highly probable. A profile north of the international boundary assuming a river valley at 7,500 feet elevation at the present mountain front and carrying pebbles to Cypress Hills at 4,800 feet for a distance of 175 miles compared with the present profile of the land surface indicates that for each strip of country one mile wide between these two areas 12¾

[9]R. G. McConnell, Cypress Hills, Wood Mountain and Adjacent Country; Geol. Surv., Canada, vol. I, p. 69C (1885).

cubic miles of sediments have been removed. This estimate takes no account of the erosion within the mountains themselves where, because of high relief, erosion would be very pronounced nor does it account for any erosion in the Cypress Hills where a conglomerate, no matter how resistant, would hardly be expected to escape destruction during the removal of such an immense volume of sediments in the surrounding area. The Cypress Hills conglomerate is Tertiary (Oligocene) in age and as now dated its deposition would be about 30 million years ago. Erosion, therefore, has been a remarkably powerful force in reducing the plains as much as 3,000 feet in elevation within the period following deposition and consolidation of the Cypress Hills conglomerate.

Crowsnest Mountain

It may well be asked if there is any geological evidence in southern Alberta to support a hypothesis whose fundamental part involves such a great amount of erosion. In this connection the physiography in the vicinity of Crowsnest Mountain may well be considered.

Crowsnest Mountain is a rounded isolated peak 9,138 feet high in which the Palaeozoic limestones that cap it have been thrust over Cretaceous sandstones and shales which form its lower part (Fig. 3). It lies two miles east of the Highrock Range which forms the crest of the Rocky Mountains where some of the peaks exceed 9,000 feet in height. It also lies eight miles west of the Livingstone Range which in this area is commonly considered a mountain outlier with foothills structures both to the east and to the west of it. At its southern end, just north of Crowsnest Pass, Livingstone mountain plunges southward and the Palaeozoic rocks which form its crest farther north disappear beneath younger rocks overlying it in orderly succession. It also rises to elevations exceeding 8,000 feet and like Crowsnest Mountain and other mountain ranges in this area, owes its height to the resistance to erosion of its limestone capping rocks. In the Highrock mountains, west of Crowsnest Peak, the structural relationships are believed to be reasonably well understood as they may be readily observed along the north edge of Crowsnest Lake. The mountains, composed of Palaeozoic limestones with precipitous slopes facing eastwards, are in reality overthrust and in all respects the structural relationships are similar to those in Crowsnest Mountain. There can be no doubt, therefore, that the fault underlying the mountains, which form the crest of the Rocky Mountains in this area, is the same as now seen in Crowsnest Mountain even though there is a two-mile gap in the continuity between them. This gap has, of course, been produced by erosion. There is no evidence to show how much farther eastward Crowsnest Mountain may originally have extended. However, since an interval two miles wide has been created on its western side, it would be reasonable to expect a considerable retreat on the eastern side from the original Palaeozoic thrust front. The higher topography east of and adjoining Crowsnest Mountain could be ascribed to the existence of such a condition.

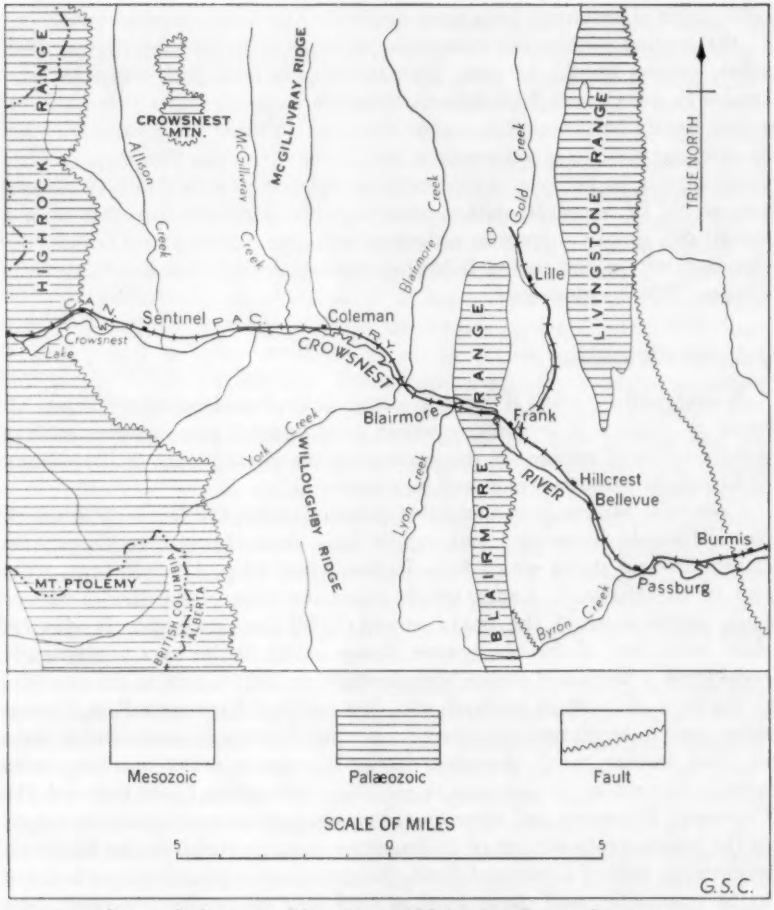


FIGURE 3. Crowsnest Mountain and Livingstone Range, Crowsnest Pass area, Alberta.

It is not possible now to determine the thickness of beds that have been removed by erosion from the top of Crowsnest Mountain where a 1,400-foot thickness of limestones is still present above the fault plane. But it is possible to restore with a fair degree of accuracy the fault plane as it must have existed at one time between Crowsnest Mountain and the main Highrock mountain mass. Such a restoration shows a minimum erosion of 1,700 feet in depth below the fault plane to the highest part of the divide now present between Crowsnest Mountain and the main mountain mass. This, then, with removal of a minimum of 1,400 feet of limestone which must have originally been present above the fault plane, indicates an erosion of more than 3,000 feet of sediments. These figures, of course, are the

absolute minimum and if the wastage of limestone from the top of Crowsnest Mountain during the erosion period should be added to this the amount undoubtedly would be much greater.

It should perhaps be pointed out here that the fault as it now appears in Crowsnest Mountain is irregular and in part synclinal. On the west side of Crowsnest Mountain the fault dips east. In the Highrock mountains it dips west. Thus the restored fault between the two must be arched or anticlinal. This indicates folding which is obviously younger than the thrust movement.

Livingstone Range

Savanna Creek Structure

The Livingstone Range, previously mentioned, begins east of Blairmore and trends northward from Crowsnest Pass. At its south end in the Pass the elevation is only slightly over 4,000 feet but a few miles north peaks over 7,500 feet high occur and still farther north at Plateau Mountain the elevation rises to over 8,000 feet. The range in its southern part is a single mountain ridge with limestone dipping west from its eastern precipitous face.

Formerly the mountain was regarded as a single westward-dipping fault block with the face on the east being the broken and somewhat eroded fault scarp. About twenty-five miles north of Crowsnest Pass there is a well-marked fold with easterly as well as westerly-dipping limestone beds in the vicinity of Savanna Creek, south of Plateau Mountain. It was the anticlinal relationships of the limestone which attracted attention and led an oil company in 1938 to drill a hole on Dry Creek to a depth of 3,375 feet. A very considerable thickness of limestone, which forms the cap of the mountain, was expected; in fact it was hoped to drill Devonian beds underlying the capping Mississippian rocks. However, at a depth of 140 feet the well passed through a fault, now known as the Livinstone fault, into Cretaceous beds which normally would lie at least 4,000 feet stratigraphically higher in the section.[10] Drilling continued in Mesozoic strata to the bottom of the hole. No production was achieved. In 1951 a second well was drilled close to the first one which had been abandoned. As it was now realized the mountain was underlain by the Livingstone fault, which is folded roughly in conformity with the observed fold at the surface, it was hoped to reach the Mississippian beds again below the upper or Livingstone fault slice in the next lower or Dyson Mountain fault slice. This slice, in turn, as known from adjoining areas, is underlain by the large Dyson Mountain fault and the hope was to obtain production above this further break. The top of the possibly productive limestone was reached at a depth of 4,400 feet and the well penetrated a porous zone which yielded a modest flow of gas, sufficient to be encouraging but hardly large enough to justify commercial

[10]J. S. Irwin, Canada's Mountains, a New Oil Frontier; Oil and Gas Jour. (June 6, 1955).

exploitation. The well was continued with the expectation of finding greater flow in deeper porous zones. However, at a depth of 5,235 feet it faulted again from Mississippian to Mesozoic strata which normally are 1,000 to 1,500 feet higher stratigraphically. This fault has been regarded by the oil company geologist, J. C. Scott, as the Dyson Mountain fault, but Douglas of the Geological Survey of Canada thinks it may be a fault within the Dyson Mountain fault slice and that the main fault lies deeper.[11] The well proceeded to drill and at a depth of 6,400 feet again reached the top of the Mississippian. In these beds, from depths of 7,210 to 8,150 feet, were many porous zones which on test yielded gas at the rate of 50 million cubic feet a day, representing a large productive well and the discovery of a new and probably large gas field.

A third well has now been completed about a mile to the east of the first. The Livingstone fault in this new well was encountered at a depth of 1,454 feet in contrast to a depth of 140 feet in the first well. This conclusively proves that the Livingstone fault is folded since it dips east on the east side of the mountain and dips west on the west side. To the east its place of emergence at the surface can also be mapped from the geological relationship and the amount of its displacement. This well also achieved commercial production and another well located at an elevation of more than 8,000 feet is now drilling. This is the highest elevation for any well ever drilled in western Canada.

Drilling in the Livingstone Range in the Savanna Creek area has conclusively demonstrated that there are two fault slices lying one above the other and there is a probability that other deeper ones may underlie these. It is not inconceivable that some of the deeper faults may extend down into the zone of flowage where perhaps the adjustments to cause the mountain building may have originated and where owing to the uplift there must have been further adjustment. The faults underlying these fault slices for considerable distances are thought to be parallel to certain incompetent beds which by their character determine the most susceptible breaking plane when subjected to high pressure.[12] In contrast to this, the breaking of the competent beds is at a much higher angle for short distances. The effect is predominantly a low angle fault only slightly steeper than the bedding. For large stratigraphic displacements, as observed, the horizontal displacements under such conditions are extremely large. This indicates a tremendous shortening in the superficial part of the earth's crust and if as now seems probable the eastern Rocky Mountains and foothills are everywhere proven to be composed for the most part of structures of a similar type, the shortening will be much in excess of previous estimates.

It is difficult to imagine relatively thin fault slices, as indicated in the Savanna Creek wells, having sufficient strength in themselves to retain their sheet-like continuity without developing extreme complexities as they

[11]R. J. W. Douglas, Geol. Surv., Canada, personal communication.

[12]R. J. W. Douglas, Callum Creek, Langford Creek and Gap Map Areas, Alberta; Geol. Surv., Canada, Mem. 255, p. 93 (1950).

were pushed forward for several miles. It is true some complexities are commonly present, but in many cases the amount of disturbance is small relative to the movement that must have occurred. It is not difficult, however, to imagine such fault slices under a heavy load of other superimposed masses developing underneath an upper fault slice. Indeed there may have been contemporaneous forward movements at different rates between two superimposed fault slices. It would appear that as well as the movement of the upper fault slice relative to the lower one, the upper one would also be carried forward by the upward and outward movement of the lower one.

It can readily be appreciated that the order of development in relation to the occurrence of an oil and gas field within a fault slice may be of great importance. If, as seems to be true in certain cases, the fault slices developed in succession from the top downward the youngest fault slices are those that appear the farthest to the east in the eastern mountains and foothills. In such a series of movements it is inevitable that the lower fault slices will be broken by faults within themselves. Such adjustments where the movements are considerable must inevitably cause warping or bending in the overlying fault slices but may not necessarily cause faulting in them. Thus in many places in the foothills the folding in the fault plates as observed at the surface may be indicative of adjustments in lower fault slices as these were thrust forward underneath the higher fault slices.[13] Certain areas of the foothills show such folding of upper fault slices to a marked degree. This, then, would seem to be related to certain peculiarities of sedimentation which cause breakage along incompetent beds accompanied by crumpling or complicated folding above areas of adjustment in lower fault slices as these have moved forward underneath their load of higher fault slices previously formed but in part contemporaneous. Such a conception of development does not preclude later folding involving all structures. It also does not preclude the possibility that the higher fault slices were themselves broken by pressures tending to push them upward and forward. It can readily be imagined that there must be a point in the upward and forward movement where each fault slice has no longer the strength to transmit the pressure to its front. When it breaks, as inevitably it must under these conditions, the down dip part undoubtedly overrides the part in front. Many breaks in a fault slice of this kind would result in the imbricated structure, as already described, since the faults separating each fault block would have their origin in the sole fault under the whole fault slice. Thus imbrication is a secondary feature of primary low angle or sole faulting.

Conclusion

In conclusion it can be said that the complexities of mountain building are tremendous but that the structural features are by no means beyond

[13]R. J. W. Douglas, Geol. Surv., Canada, Mem. in course of publication, Mt. Head map sheet.

geological interpretation. Quite a number of wells have been drilled in the foothills and in some the cost has exceeded one million dollars. This may seem to be an expensive method of finding how mountains are built but the prize for discovering a new oil or gas field is great. With increasing knowledge now becoming available, the search for productive structures is becoming even more intense than it has been in the last few years and success is being attained in areas that previously had seemed to offer no prospects because the structural conditions were not understood. There can be no doubt that the elucidation of the structural history of the Rocky Mountains and foothills is progressing rapidly and favourably under the impetus of economic rewards and that the solving of the many structural problems will result in the creation of new wealth by the further development of natural resources.

APPENDIX B

BIOGRAPHICAL SKETCHES OF DECEASED MEMBERS

André Joseph Cipriani

1908–1956

THE sudden death of Dr. A. J. Cipriani in the Deep River hospital on February 23, a few hours following a stroke, came as a great shock to his wide circle of friends, by whom he will be greatly missed. His decease at the early age of 47 has removed the leading authority in Canada on the biological and medical aspects of atomic energy. As Director of the Biology Division of the Atomic Energy of Canada plant at Chalk River since the start of the Project, he had become a scientist of international reputation in this field of research and had created a laboratory unique in the breadth of the fundamental and applied investigations that its staff are performing. He pioneered the development of the Cobalt 60 therapy units which are now widely used in the treatment of malignant diseases, as well as promoting many investigations in various fields of limnology, silviculture, and health physics. Many outside government laboratories sought his advice, always freely given, and many of those visitors who came to work with him during the summer months from such establishments and universities will recall with gratitude the wise assistance he has given them.

Cipriani was a member of numerous national and international committees. He was Canada's representative on the International Commission on Radiological Protection and was chairman of that commission's subcommittee on the handling and disposal of radioisotopes. He was the Canadian representative on the United Nations scientific committee to study the effects of atomic radiation. He assisted in the organization and training of the army radiation detection unit and, because of his firm control and administration of the health physics programme, no employee at the Chalk River Plant has received excessive harmful radiation. He contributed many scientific papers to various international meetings, including the Geneva Conference on "Peaceful Uses of Atomic Energy" last August, and also to journals, as well as writing sections for British medical encyclopaedias. He was elected a Fellow of the Royal Society of Canada in 1954.

Dr. Cipriani was born in Trinidad, April 2, 1908, the son of the late Leo P. Cipriani, a barrister-at-law, and his wife, Hélène Sellier. He entered St. Joseph's College at the age of five, and St. Mary's College in October, 1918. In July, 1922, he passed his Junior Cambridge examination under age and continued at school, obtaining the School Certificate with honours in 1924. The following year he was awarded the Stollmeyer Silver Medal for Science and obtained the Science Scholarship in July, 1927. He was an outstanding pupil from the time he entered school and was considered by the Principal as a promising scholarship candidate.

In 1928 he came to McGill with a Trinidad Island Government Scholarship and entered the Faculty of Applied Science, winning at the end of his first year a prize for mathematics, descriptive geometry, and physics.

His ability and interest in mathematics caused him to transfer at the end of his second year from engineering to the honour course in Mathematics and Physics, from which he graduated with first class honours and the B.Sc. degree in May, 1932. In the following year he completed the course work for his Master's degree in physics and at the same time took some fourth-year work in electrical engineering.

Being a man of wide interests and perhaps motivated by the scarcity of employment in the field of physics during the depression years, he entered the Faculty of Medicine at McGill in 1933. During the second and third years of his medical course he held a Banting Research grant, and assisted Dr. Wilder Penfield in his spare time with various electronic and physical devices. During the next two years he interrupted his medical studies and worked full time at the Montreal Neurological Institute to assist Professor Penfield and his staff with electronic equipment in connection with neurophysiology. He received the M.D., C.M. degree in 1940, graduating near the top of the class.

For the next few years he worked in the Neurological Institute on the development of various electrical contrivances in connection with electroencephalography which he designed on the basis of his knowledge of physics, engineering, and medicine. Then he joined the Army Medical Corps in 1943 as a Captain, working under the Director General of Medical Research. He was consulted about almost every medical research problem requiring a knowledge of physics or engineering, which meant that he did considerable travelling both in Canada and overseas. His work thus covered such diverse subjects as night-vision, lighting of vehicles, and the investigation of sea-sickness. On the conclusion of hostilities, he left the army with the rank of Major in the spring of 1945 to join the Atomic Energy Project, Chalk River.

Cipriani was a man of striking personality; along with his tremendous ability and sound judgment, there was always a lighter touch, a sense of fun. He worked hard and took his work, but never himself, seriously. He was popular among scientists and local country inhabitants alike, well known throughout the Ottawa Valley as an enthusiastic fisherman. Immensely fond of children, he took special pleasure in interesting them in natural phenomena—insects of various kinds which he bred at the laboratory, flowers, and geological specimens. Any week-end in the summer, he could be seen in his open Model A Ford car, which he found useful for his fishing expeditions, giving his own and other children a ride round Deep River, managing a huge load with kindly but firm discipline.

In 1941 he married Alice Gertrude Croasdell, daughter of Mr. Rex Croasdell, Florida, and the late Mrs. Croasdell. She made his home a happy and congenial place in which they entertained many of his friends who came to visit the Project. He had four daughters: Janet, Mary, Julia and Katherine, the eldest eleven years old and the others each two years apart. Mrs. Cipriani will continue to live in Deep River with her family in the only home the children have known. Besides his wife and children, he is

André Joseph Cipriani

survived by his mother; three sisters, Louise, Madelaine, and Marie de Pass; and one brother, Jean, all living in Trinidad. He also leaves one maternal aunt, Miss Jeanne Sellier in New York, who always followed his career with special interest.

In the passing of André Cipriani, a much-loved figure has departed from the Canadian scene, and physicists and his many medical friends everywhere extend their deepest sympathy to his widow, his four young daughters, and other members of his family.

David A. Keys

William Egbert Cockfield

1890–1956

DR. W. E. COCKFIELD, senior geologist of the Geological Survey of Canada and an accepted authority on the geology of British Columbia and Yukon Territory, died in the Vancouver General Hospital of a heart attack on January 4, 1956. He had been ill since late October, 1955.

William Egbert Cockfield was born in Montreal on September 23, 1890. He attended preparatory schools in Montreal, and McGill University. He received from McGill his B.A. degree in 1913, his B.Sc. degree in mining engineering in 1914, and his M.Sc. in geology in 1915. While attending McGill he won the Douglas Fellowship and British Association Medal. His studies in geology were continued at Princeton University where he held various fellowships and received the Ph.D. degree in economic geology in 1918.

Dr. Cockfield commenced field work with the Geological Survey as a student assistant in 1912. In 1918 he was appointed to the staff of the Geological Survey as an assistant geologist and in 1920 he was promoted to associate geologist and his appointment was made permanent. In 1926 he was promoted to rank of geologist and in 1947 to senior geologist. Dr. Cockfield reached retirement age on September 23, 1955, but had been retained by the Geological Survey in a consulting capacity and held this position at the time of his death.

In 1929 Dr. Cockfield was appointed geologist in charge of the B.C. office of the Geological Survey. He held the position until his retirement date.

His field work was carried out entirely in the Yukon Territory and British Columbia, and he was an accepted authority on both areas. He published 20 geological maps, 35 geological papers, and 5 geological memoirs. The majority of these publications deal with regional and mining geology. In addition Dr. Cockfield had extensive experience in engineering geology and prepared many unpublished reports especially on damsites on the Columbia and Fraser rivers. His last major geological field work was to prepare a geological report and supervise the exploratory diamond drilling of Ripple Rock. At the time of his death he was preparing a new index of the publications of the Geological Survey.

Dr. Cockfield was a Fellow of the Royal Society of Canada and the Society of Economic Geologists. He was a very active member of the Canadian Institute of Mining and Metallurgy: in 1944-5 he was chairman of the Vancouver Branch; in 1946-7 and 1953-4 he was vice-president for District 6; in 1932-4 and 1951-3 he was councillor for District 6. Dr. Cockfield was most active in the B.C. Section of the Institute for twenty-five years, serving as chairman in 1946-7 and in all the other positions except secretary at various times. He served as treasurer for at least fifteen

years and the Section owes much of its success to the work he did in this capacity. He saw that no money was wasted.

Dr. Cockfield served on the B.C. War Metals Research Board and for two years on the Board of Management of the B.C. Research Council.

Dr. Cockfield is survived by his wife, Ouida, whom he married in 1919, two daughters, Mrs. L. McMahon (Shirley) of Whittier, California and Mrs. H. Payne (Evelyn) of Vancouver, one grandson, four granddaughters, a brother, and sister.

Dr. Cockfield was a member of Ryerson United Church. His hobbies were colour photography, reading and good conversation but at all times his main interest in life outside his family was geology and mining.

Funeral services were held in Vancouver January 6 followed by cremation.

J. E. ARMSTRONG

William Egbert Cockfield

Charles William Colby

1867–1955

CHARLES WILLIAM COLBY, B.A. (McGill), A.M. and Ph.D. (Harvard), F.R.S.C., Chevalier of the Legion of Honour, was born March 28, 1867, at Stanstead, Quebec, and died in Montreal, December 10, 1955. He came of old Yankee stock, his father the Hon. Charles Carroll Colby coming from Vermont to Stanstead in his youth. A noted lawyer, Charles Carroll Colby was M.P. for Stanstead from 1867 until 1891 and was a member of Sir John Macdonald's government from 1889 to 1891.

The late Dr. Colby was a brilliant scholar and student who devoted more than half his long life to scholarship and teaching. He was for twenty-five years Professor of History at McGill and, at a time when the study of Canadian history occupied the attention of Canadian scholars far less than it does today, he published *Canadian Types of the Old Régime* in 1908, and *The Founder of New France, a Chronicle of Champlain* for the "Chronicles of Canada" series in 1915. He served on the Canadian History Manuscript Commission (1907) and was a member of the Canadian Historical Association and the International Congress of Arts and Sciences. He also was a member (1905) of the Louisiana Purchase Exchange.

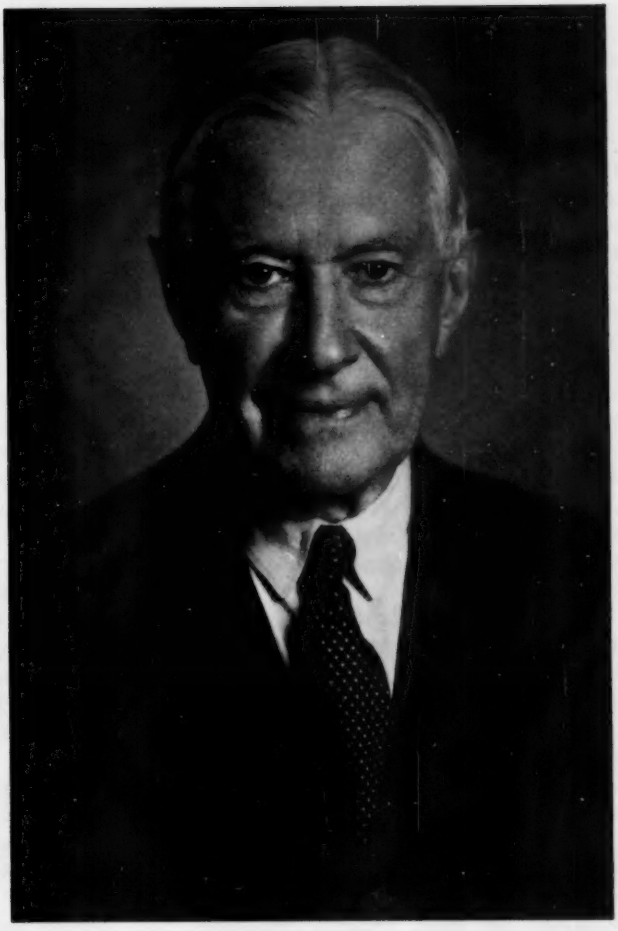
He first taught at McGill in the Department of English, and later as Kingsford Professor of History from 1893 until 1910. After his father's death he had to assume many important business interests, notably as a director of the Canadian Bank of Commerce and of the Remington-Rand corporation.

He maintained his scholastic contacts as a Governor of McGill until he resigned in 1947. He was the recipient of honorary degrees not only from McGill, but from Bishop's University.

An acute mind and deep learning combined to give him a reputation as a scholar, and his singular capacities as lecturer and teacher are still remembered and deeply appreciated by the generations of undergraduates who sat in his classes. Courtly, urbane, and charming, he was a "gentleman of the old school" who nevertheless was also possessed of a first-class business brain.

He is survived by his son, Charles C. Colby, of Montreal and a sister, Miss Jessie Maud Colby, of Stanstead.

G. V. FERGUSON



Charles William Colby

Harold Caswell Cooke

1884–1956

ON March 6, 1956, there passed away in Montreal in the person of Harold Caswell Cooke a distinguished Canadian geologist who had in a variety of capacities given unreservedly of his time and talents to the Royal Society of Canada.

H. C. Cooke was born at Baltimore, Ontario, on April 27, 1884. He took his undergraduate studies at the University of Toronto specializing in chemistry and mineralogy. He graduated with the degree of Bachelor of Arts in 1907 and in the following year with his Master's degree. He next proceeded for graduate studies in geology to the University of Chicago where he obtained his degree of Doctor of Philosophy in 1912. He followed this with a year of special training in Precambrian geology at the University of Wisconsin.

Dr. Cooke's field studies in geology began in the summer of 1905 when, still an undergraduate, he served as field assistant to Dr. W. H. Collins, later Director of the Geological Survey of Canada. He worked with Collins for six successive summers, 1905 to 1908 along the line of the Grand Trunk Pacific railway which was under construction in those years, and in 1909 and 1910 in the Gowganda area then much in the public eye on account of its silver possibilities. In 1911 he worked with A. C. Lawson in the Rainy Lake region of western Ontario.

In 1912 Dr. Cooke was appointed to the staff of the Geological Survey of Canada and remained a valued officer of that branch until his superannuation on April 27, 1949. During this long period of service his main fields of investigation were two—the Precambrian rocks of the Canadian Shield and later that region of complicated Appalachian structure, the Eastern Townships of southwestern Quebec. In both of these his geological studies added much to our knowledge of both the theoretical and the economic phases of the science. In the former field his first area of investigation was the Broadback River belt of Quebec where his structural studies on Keewatin lavas became classic. Later he worked in the Matachewan district, the Larder Lake region, and then from 1922 to 1929 in that important mineral belt extending eastward from the Ontario-Quebec boundary, including Noranda and other important mining properties.

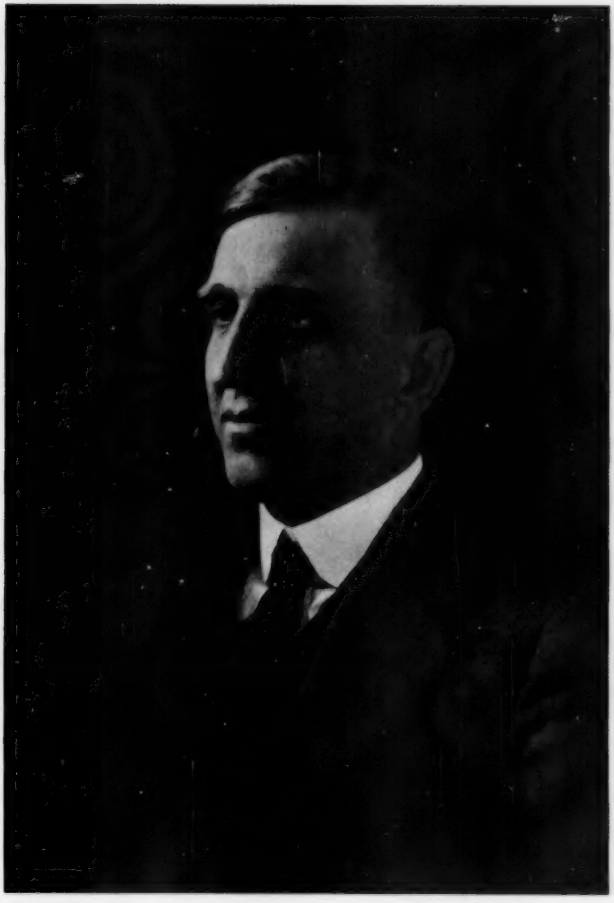
His investigations in his other field of activity concerned chiefly the region in which lie the great asbestos deposits of Quebec, a belt mainly composed of Palaeozoic rocks. Here again his detailed geological mapping and structural studies did much to elucidate the history of that intricate region and in particular throw new light on the origin of the asbestos mineralization. In this connection his Geological Survey Memoir, No. 211, "Thetford, Disraeli, and Eastern Half of Warwick Map-Areas, Quebec" is an outstanding contribution to geological literature.

On his retirement from the Geological Survey Dr. Cooke moved to Montreal. He continued active geological work, in the summer months carrying out further field studies in the Eastern Townships for the Department of Mines of the Province of Quebec, and in the winter months lecturing in geology at Loyola College, University of Montreal.

Dr. Cooke was a familiar figure at meetings of the Canadian Institute of Mining and Metallurgy of which he was a member since 1914. It was, however, to the Royal Society of Canada that he gave the greater portion of his time and interest aside from his regular duties. Elected a Fellow in 1923, he served as Secretary of Section IV from 1935 to 1939, as Vice-President of that Section in 1939-40 and as President of the Section in 1940-1. He was Honorary Treasurer of the Society from 1936 to 1947. In that period his careful watch over the Society's funds and investments resulted in a considerable improvement in its financial position. In the Society's anniversary volume *Fifty Years in Retrospect 1882–1932* he was the author of the chapter "The Growth of Theories of the Formation of Ore Deposits in the Last Fifty Years," and he contributed numerous other papers to the Transactions of Section IV.

Dr. Cooke is remembered by his many friends for his enthusiasm for his work, for the clarity of his thinking, for the excellence of his writing, and for the forcefulness of his personality and character. He is survived by his widow, Anna Katherine (née Herriman), and by a son Terrence Wilfred.

F. J. Alcock



HAROLD CASWELL COOKE

Théophile Constant Denis

1872–1955

WHEN Dr. T. C. Denis passed away on August 20, 1955, the Royal Society lost one of its older members. This death marked the ending of a long period of eminent service to his province and to the nation, and a host of people from one end of Canada to the other, as well as abroad, mourned the departure of one who truly was a fine, kindly gentleman in every sense of this word.

Théophile Constant Denis was born at Douai, France, on February 25, 1872, to Anna Pinart Carpentier and Léopold Denis, agronomist and chief of the sugar beet industry in the Ardennes. He came to Canada at the age of nine when his father became director of the Union Sucrière Franco Canadienne at Berthierville in the province of Quebec. His early education was received in primary schools in France and in the Berthier grammar school. He then entered McGill University and graduated in civil engineering (B.Sc. '96) and then in mining engineering (B.Sc. '97). Following graduation, he remained one session (1897-8) at McGill as a demonstrator in geology and mineralogy.

From 1898 to 1907 Dr. Denis was on the staff of the Geological Survey of Canada: in the period 1898-1901, he was technician occupied with mining and mineral industry statistics; in 1901-6, he prepared geological maps in Alberta, British Columbia, and Ontario; and in 1906-7 he initiated and conducted for the Survey a study and sampling of coal mines. In 1907 he transferred to the newly formed Mines Branch of the federal Department of Mines, where he continued the studies of coal in British Columbia, Alberta, Manitoba, New Brunswick and Nova Scotia, and also made studies of various other mineral resources in Canada. This position he relinquished in 1910 when he was appointed Superintendent of Mines for the Province of Quebec.

With this appointment began more than forty years of service to the mineral industry of Quebec. Indeed it may be said that 1910 marks one of the turning points in the history of geological investigations in that province: Dr. Denis inaugurated a new era for Quebec in mining and geological exploration. Under his direction, the staff of Quebec's Bureau of Mines (as the present Department of Mines was then called) was gradually expanded even if, for many years yet, it was still necessary to rely on geologists engaged for field work in summer only. As another biographer has stated, "It is not too much to say that the rapid increase both in diversification and in total volume of the mineral output that followed was largely the result of the farseeing policy initiated by Dr. Denis."

In addition to his administrative duties as head of the Bureau of Mines in Quebec, Dr. Denis, especially during the earlier years of his régime when his staff was a meagre one, on many occasions had to carry out field work in widely separated parts of the province. In 1922 he made the first

geological reconnaissance of the copper deposits that had just been discovered the previous year at the head of York River in Gaspé peninsula, when the only means of access was overland by a route blazed through the forest. At that time there was not even a trail; now there are wide motor roads leading to the thriving town of Murdochville which has been built around the recently opened and important mining and smelting operations of Gaspé Copper Mines Limited.

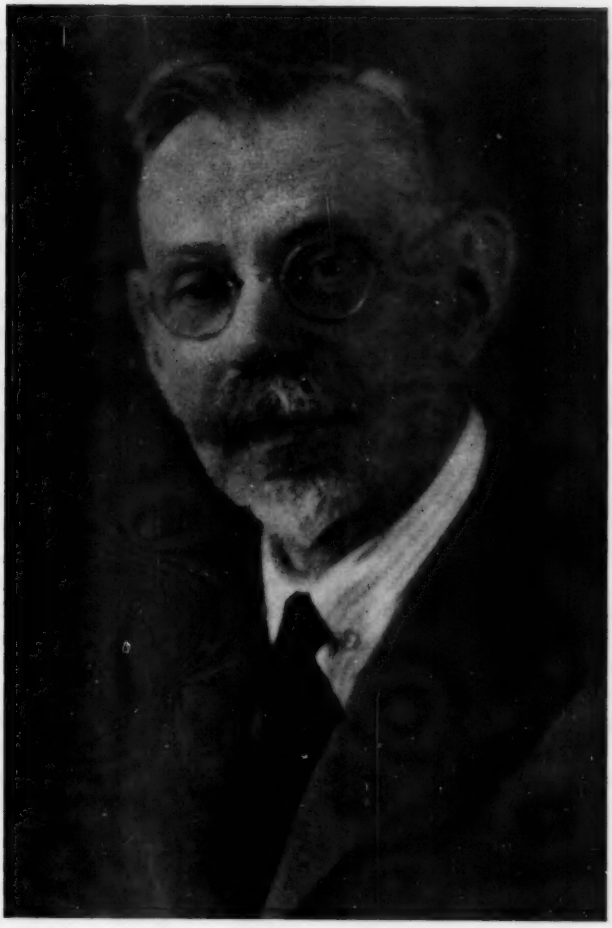
In 1927, feeling that younger hands should guide the Bureau, Mr. Denis voluntarily relinquished his directorship but continued until 1952 as Technical Adviser to the Bureau (and, later, Department) of Mines. His mastery of both the English and the French languages—a gift rarely held to such a perfect degree—was constantly employed during this period when he supervised and did much of the work in preparing for publication the large number of geological and other manuscripts that passed through his hands. He set a high standard of writing of which the Quebec Department of Mines is justly proud. During the latter part of this same period, in collaboration with the late Dr. John A. Dresser, also a Fellow of the Royal Society of Canada, Dr. Denis was responsible for compiling the comprehensive, three-volume *Geology of Quebec* which has been much in demand by geologists, students, and engineers interested in the geology and mining development of this province.

Dr. Denis was elected a Fellow of the Royal Society of Canada in 1926 and served as Vice-President of Section IV. He was also a member, from 1899, of the Canadian Institute of Mining and Metallurgy, serving a number of years as a Member of Council and as Vice-President in 1923-4; in 1943 he was honoured by being designated a Life Member of that Institute. He was also a member of the American Institute of Mining and Metallurgical Engineers and of the Corporation of Professional Engineers of Quebec. In addition to his duties with the Government of Quebec, Dr. Denis, from 1916 until 1927, held an appointment as Professor of Mineralogy and Geology at Laval University. It was this university that conferred upon him, in 1935, an honorary degree of Doctor of Science, in recognition of his outstanding contribution to the development of the mineral industry in Quebec and in Canada.

Dr. Denis once had planned to retire fully, but with the death in 1935 of Mrs. Denis, formerly Margaret Tyrrell, whom he had married in Ottawa in 1901, these plans were changed. Feeling keenly the loss of his devoted companion, he chose, instead of the happy retirement to which they had been looking forward, to continue his work and did so for nearly another twenty years until the end of 1952 when, after a long and fruitful career, he finally relinquished his duties.

Surviving are two sons, Bertrand T., of Quebec, also a Fellow of Section IV of the Royal Society of Canada, and Frank T., of Montreal, as well as a brother, Léo G. Denis, also of Montreal. We have here one of the few instances in which a father and a son were Fellows of the Society at the same time.

I. W. Jones



Théophile Constant Denis

William Creighton Graham

1887–1955

WILLIAM CREIGHTON GRAHAM was born at St. Mary's, Ontario, in 1887, of Scotch-Ulster stock on both sides. When he was seven his family moved to Toronto. Attending Harbord Collegiate Institute, he became deeply interested in biology, as did other bright boys in that school, but finally decided on theology and the ministry. He entered the Pass Course in Victoria College, 1908, Hebrew being one of his subjects, and a year later was qualified for senior matriculation standing. He had decided to enter the honour course in Oriental Languages, and to study Greek. He was late in entering Greek, but he showed marked linguistic ability and soon overcame his handicap in that subject. He was a confident rugby player and something of the same spirit could be observed in his manner of study. In his first year in the honour course he stood in the first class, in his last two years he ranked very high in the first class in Oriental Languages. He was granted the B.A. degree in 1912; M.A. in 1913; B.D. in 1914; and S.T.M. (Harvard) in 1915. In this last year he joined the Canadian army as chaplain, and was in France for a year. He became attached to the Fort Garry Horse—an association which he always treasured. In the same year he had received a teaching appointment in Wesleyan College, Montreal, and before the war ended he became its registrar and Professor of Old Testament.

In 1924 he began postgraduate studies in Oriental Languages at the University of Chicago, and was granted the Ph.D. degree in 1926, when he was immediately appointed Associate Professor of Old Testament Languages and Literature; three years later he became Professor in this department of the University of Chicago. In these years he published two books: *The Prophets and Israel's Culture* and *Culture and Conscience*.

In the year 1936-7 Dr. Graham was Professor in the American School of Oriental Research at Jerusalem. He went out as a teacher in the School, not as an archaeologist. Yet it came about that he was to play a part in two "finds." One had to do with the unearthing of blast furnaces used for smelting King Solomon's copper on the Gulf of Akaba; another was the discovery of clay tablets, inscribed in a language akin to Babylonian, which Dr. Graham deciphered. In the official reports on the year's work by the school his distinct contributions to both discoveries were mentioned.

In 1938 Dr. Graham became Principal of United College, Winnipeg, and so continued till the summer of 1955, shortly before his death. With much reluctance, yet with new high purposes in view, the scholar turned administrator. He took charge at a difficult time: the West had suffered greatly in the depression; the Second World War was just a year away; the professors in the College had been very poorly paid; the general drift in education was towards the practical and away from the humanities. United College, affiliated with the University of Manitoba, is partly a theological

school of the United Church, partly an Arts college, partly a collegiate institute. Its student body is made up of many races and religious creeds. The institution was the successor to the Presbyterian Manitoba College and the Methodist Wesley College, in both of which there had been eminent teachers, at a time when the province as yet took no part in higher education. The tradition continued in United College despite great hardships.

Dr. Graham carefully took stock of the whole situation, and brought to bear on it his beliefs and enthusiasms. He was an ardent, though not a narrow-minded Christian. He was a firm believer in liberal education. He was an upholder of the dignity of the teaching profession of all ranks. He fervently maintained that educated men had a higher responsibility in the duties of citizenship. The church could not overlook the supreme importance of liberal education, and its college must rank intellectually with the highest secular institutions. He set himself, with some success, to increasing professors' salaries. He used his influence unceasingly to maintain a worthy curriculum in the University at large.

When the Second World War ended a host of government-pensioned veterans enrolled in our universities. Many thought them the best university material the country had ever seen. But their numbers were formidable. United College had to use old sheds and basements in nearby buildings for classrooms; its library accommodation was woefully inadequate. The Principal rose to the task. Such was his example that nearly his entire teaching staff and many of the students canvassed the city of Winnipeg and many other places. The work was done on Saturdays and Sundays, and on weekday evenings. Slowly the money was found for a new building on the campus. That story speaks for the Principal's relationship with staff and students: they were his friends.

Dr. Graham received many honorary degrees. He became a Fellow of the Royal Society of Canada in 1947.

In June, 1914, he married Miss Ella Cook, of Toronto. They had four children, three of whom survive: Mrs. J. B. Nichols of Pensacola, Florida; Dr. Roger Graham, on the teaching staff of the University of Saskatchewan; Dr. John Graham, on the teaching staff of the University of Western Ontario. His widow survived him very briefly.

CARLETON STANLEY

WILLIAM CREIGHTON GRAHAM

Ertle Leslie Harrington

1887–1956

ERTLE LESLIE HARRINGTON, Professor Emeritus and former Head of the Department of Physics, University of Saskatchewan, died after a short illness at Oakland, California, on January 31, 1956. Following his retirement from formal duties at the University of Saskatchewan in 1952, he continued to practise his profession at the United States Naval Ordnance Hospital, Corona, California, until six weeks before his death. He is survived by three sons and one daughter, Harrel L. Harrington of Oakland, California, Roger E. Harrington of Lakewood, Ohio, Frank W. Harrington of Saskatoon, Saskatchewan, and Mrs. R. Gray of Rochester, New York. Mrs. Harrington died in 1952.

Dr. Harrington was born in Bucklin, Missouri. He received all his public school, high school, and university undergraduate education in Missouri. A Bachelor of Science degree in 1910 from the University of Missouri was followed by a Bachelor of Arts degree in 1911 from the same university. The next seven years were spent completing his graduate training and getting experience as a teacher. The former included a M.A. degree in 1915 from Harvard and a Ph.D. degree in 1916 from Chicago, the latter in serving for various periods of time as a Superintendent of Schools in Missouri, Head of the Department of Physics at the Missouri State College for Teachers, and Instructor of Physics at Chicago. Prior to coming to Saskatchewan in 1920, he was a research physicist with the Westinghouse Lamp Company for two years. He was appointed head of the Department of Physics at Saskatchewan in 1924, on the death of the senior professor, Dr. A. G. McGougan.

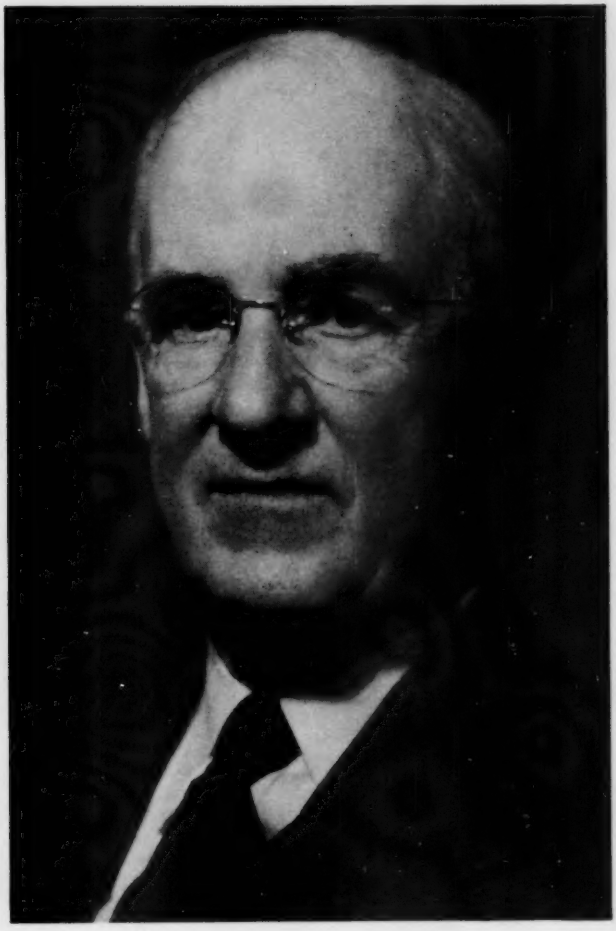
A wiser choice for the head of a developing physics department in a university drawing its students from an agricultural province still close to the pioneer stage could hardly have been made. An enthusiastic and active interest in the application of physics to all sorts of everyday problems; a talent for developing experiments and demonstrations requiring minimum expenditures for equipment and labour; high standards of responsibility for himself, for his staff, and for his students; a firm belief that students from rural communities had acquired manual skills and a resourcefulness that more than compensated for any academic handicaps which they had experienced prior to coming to university; a friendly and at times even a fatherly interest in the personal and academic problems of his students and staff; and an open-door policy that made him readily available to all, often at great inconvenience to himself, were attributes that became increasingly evident as the years passed. These were mostly responsible for his success in attracting a relatively large number of able students to careers in physics and in maintaining a reasonably permanent staff, keenly interested in teaching and research.

Dr. Harrington was at heart a gadgeteer—a gadgeteer, however, who applied severe tests of practicality and economy of construction to all his efforts. Hardly a week passed without his displaying to his colleagues and students some modification to a piece of equipment, or an experiment, or a demonstration which added either to its efficiency or to its effectiveness in illustrating principles for which it was intended. Three of his developments related to laboratory equipment; an aspirator of high efficiency, a laboratory clock operating on alternating current, and a nesting base for laboratory stands are used widely on this continent. A major portion of the elementary laboratory experiments and the lecture demonstrations of the Saskatchewan Physics Department possess features that bear testimony to his ingenuity and resourcefulness. Even the high schools were not overlooked. A manual of laboratory exercises, requiring materials that could be obtained mostly from the home, the local garage, and the junk pile on many a farm was prepared for schools with modest budgets. Many young teachers found in it the inspiration to improvise experiments and demonstrations for other sciences as well as physics from materials readily obtainable within their communities.

An investigation on the physics of curling made soon after he came to Canada and reported in the Transactions of this Society brought to him the questionable reputation of trying to ruin the "roarin' " game. Careful checks on the motion of swept and unswept rocks had failed to show an effect from sweeping as long as the ice was clean, and so he reported. Publicized widely by newspapers and magazines, his report brought him letters criticizing his findings for years afterwards. His replies, attempting to distinguish between the psychology and the physics of curling, seldom satisfied his more rabid critics. Now it can be said publicly that the only times that Dr. Harrington was known to miss a University Council or Faculty meeting were times when he was scheduled to curl. No one loved the game more, or swept more vigorously at critical moments, than he did.

Of his many interests in the application of physics to practical problems, the one related to medicine had the most important consequences. More than thirty years ago, he began to insist that the medical practitioner and the biologist of the future would require far more training in physics than had previously been the case, and that students going into these fields should be given physics courses more suited to their needs. In 1928, he started an introductory course for such students using examples, problems, and experiments that were medical and biological rather than engineering. Since then, most universities have started similar courses, many using his as a model. A textbook on general physics for students of medicine and biology was completed just before his retirement.

Because of his interest in medical physics, the Saskatchewan Cancer Commission asked him to design and to build a radon plant. Possessing unusual skill as a glass-blower, he constructed all the extensive glass units required, including many novel features that added to the plant's efficiency. This was installed at the University, and was operated under his direction



ERTLE LESLIE HARRINGTON

until his retirement. In addition, he served as a consultant to the Cancer Commission on the use of high-energy radiations. When the Commission's needs became too numerous for him to handle along with his many other duties, the logical course was to attach a man to his Department who would specialize in radiation physics. From this appointment followed the first betatron treatment of cancer patients, a cobalt-60 unit designed especially for radiation therapy, and numerous publications on X-ray dosimetry, all of which brought an international reputation to Saskatchewan for work in this field.

His investigations into the more fundamental aspects of physics were on such subjects as the viscosity of air, the relative importance of the Bernoulli effect and of viscosity on aspirator performance, the existence of aggregates of active deposit atoms in gases containing polar molecules, the mobility of radioactive aggregates, and the absorption cross-sections for thermal neutrons. He was made a Fellow of the American Physical Society in 1928, and of the Royal Society of Canada, Section III, in 1932. He was President of the Section during the year 1946-7; and served as Editor of Section F of the Canadian Journal of Research for a number of years.

While his reputation as a scientist and teacher rests upon a substantial and permanent basis, he will still be best remembered by all who knew him for his friendliness, his willingness to spend almost unlimited amounts of time in helping others, and his deep and abiding interest in the welfare of his colleagues and students. His office door was usually open—an invitation to enter that brought a steady stream of people to his desk. Members of his staff came for help in designing experimental and research equipment, brought their manuscripts for criticism prior to submitting them for publication, and sought advice on more personal matters ranging from the merits of houses which they intended to purchase for homes to the best way of stoking a furnace. Students came for help with their academic difficulties, counsel in selecting courses, assistance in getting scholarships and positions, and not infrequently with their financial worries. All met with a warm, friendly greeting, received a sympathetic consideration of their particular problems, and seldom left without a worthwhile suggestion and a promise of further help when this was necessary.

The students specializing in physics were his particular concern and pride. Giving them a sound training in physics and a desire to do original work was not enough. Only if they developed into well-balanced individuals was he really satisfied. Compulsory participation in seminars during their senior years, a Physics Club in which the emphasis was on social affairs, Physics Shows for the public which were organized and put on by the students, and Sunday gatherings in his home were some of the methods which he used to achieve this end. The Sunday gatherings were memorable events. Starting in as teas presided over by Mrs. Harrington and in the company of their children, they seldom ended until late in the evening—often with a rousing sing-song, with Dr. Harrington playing the piano.

Tangible evidence of their deep regard and appreciation of all that he had done for them was shown by his students when he retired. Largely through their contributions an annual prize, known as the E. L. Harrington Prize, was endowed. This is awarded to the physics graduate who during his previous four years has best exemplified the qualities that were so dear to Dr. Harrington: academic proficiency, interest and skill in experimental techniques, and leadership among the physics students.

B. W. Currie

Arthur Lacasse

1870–1955

L'ABBÉ ARTHUR LACASSE est décédé le 10 juin 1955. Il fut admis à la Société Royale, section I, en 1924; il s'en retira en 1938.

Né à St-Anselme de Dorchester en 1870, il fit le cours classique au Séminaire de Québec de 1882 à 1890, ainsi que ses deux frères, Gustave et Joseph. Gustave devint journaliste au Canada et aux Etats-Unis; Joseph choisit le sacerdoce; ces deux derniers moururent encore assez jeunes, tandis qu'Arthur devait dépasser les 80 ans. Un autre, Cyrille, lui survit.

Ces hommes se firent remarquer par une grande distinction de manières, un raffinement de gentilhomme, un dévouement sans bornes aux bonnes causes; la politesse, la distinction, l'affabilité, la bonne humeur étaient choses sacrées dans la famille rurale dont ils sont issus.

Arthur Lacasse fit de bonnes études au Séminaire; il n'y fut pas le premier de sa classe, car il avait à lutter avec des garçons brillants, tels Camille Roy et Alfred Paré; cependant il fut parmi les dix premiers de la classe. Il ne remporta pas de prix, mais il eut bon nombre d'accessits. Son travail est ordinairement qualifié de bon et de très bon; la conduite aussi. Sa mémoire paraît avoir été un problème pour ses professeurs; ils la notent, d'année en année comme difficile, heureuse, bonne, difficile, très bonne, assez bonne.

A cette époque on pratiquait les vers latins pendant quatre années; Lacasse ne paraît pas s'y être intéressé beaucoup, car il n'y remporte pas même un accessit. L'intérêt portait alors sur la littérature française, celle du 17e siècle en classe, et la romantique pour les lectures libres. L'école littéraire de 1860 attirait les jeunes esprits.

Après les études de théologie et l'ordination sacerdotale, l'abbé Lacasse fut vicaire, puis curé. Il choisit vite d'imiter les curés littérateurs, qui représentent un fort contingent dans notre histoire littéraire : Apollinaire Gingras, David Gosselin, Auguste Gosselin, Charles-Edouard Mailhot, Gustave Bourassa, J.-Bte Allaire, Elie Auclair, Aristide Magnan, le Chanoine A. H. Scott, Henri-Raymond Casgrain, le Chanoine Robitaille, Azarie Couillard-Dupuis; à qui il faut ajouter les prêtres de collèges : Mgr Douville (de Nicolet), Amédée Gosselin, Camille Roy, Mgr Emile Chartier, et d'autres : l'abbé Joseph Raiche, et Henri Beaudé (d'Arles), Ivanhoe Caron, Mgr Lindsay, P. V. Charland, J. M. Melançon (Lucien Rainier), A. G. Morice, Benjamin Louis Honoré, Louis-Adolphe Paquet, Mgr Racine, Léon Provencher, le Chanoine Huard, les Frères Marie-Victorin, Antoine Bernard. Cette liste n'est pas complète, certes, mais elle donne idée de la phalange des prêtres séculiers, réguliers, des Frères, qui ont largement contribué à l'élaboration d'une littérature canadienne d'expression française. Ils se sont surtout occupés de religion, de philosophie, d'histoire; mais certains ont été poètes, tels Gingras, d'Arles, Melançon (Rainier), et Lacasse.

Quelles influences ont poussé Lacasse à faire des vers ? Ce n'est pas celle du Séminaire, car la sévérité de ce milieu prohibait les exercices de vers français ou bien donnait comme règle et modèle l'illustre Boileau, dont on apprenait par cœur l'Art poétique.

Une première influence fut celle du réveil de 1900, avec la campagne nationale d'Henri Bourassa, les grandes fêtes du Cinquantenaire de la Charte universitaire, la fondation de la Société du Parler français et celle de la Société Symphonique de Québec, et celle de la Société de l'Assomption chez les Acadiens. Ce fut certes un réveil national; non pas une explosion subite, mais la suite du mouvement littéraire de 1860 et des grandes célébrations de la fête de St-Jean-Baptiste en 1889.

Une second influence fut celle de Camille Roy, ce prêtre, ce professeur, ce recteur d'Université qu'on a appelé le grand seigneur des lettres canadiennes. Camille Roy fut un élève brillant au Séminaire; il était d'une famille rurale fort remarquable par la quantité et la qualité de ses enfants. En 1901 il revenait de Paris, où il avait employé trois années à préparer la licence ès lettres à la Sorbonne. Il prit l'enseignement de la Rhétorique, qu'il garda vingt-cinq années. Il entra aussitôt dans le mouvement de réveil national et il se mit à prêcher la nationalisation de notre littérature; il fut, avec son frère Paul-Eugène Roy et avec Adjutor Rivard, l'un des fondateurs de la Société du Parler français. Il entreprit le premier essai sérieux de critique littéraire sur les écrits canadiens-français. Sa critique était polie, bienveillante et encourageante; il a lancé plusieurs jeunes écrivains. L'abbé Lacasse était son confrère de classe, il rimait en secret dans ses loisirs de vicaire, inspiré par son goût naturel et par le mouvement national. Il résolut un jour de montrer à Camille Roy ses strophes, et il reçut l'encouragement à publier et à continuer.

Une troisième influence s'exerce aussi sur Lacasse, et c'est celle l'Adjutor Rivard, et de deux façons.

Rivard s'intéressa de bonne heure à la littérature régionaliste, et même patoisante de la France. Il se composa une bibliothèque des ouvrages en prose et en vers, de ce genre, peut-être une collection unique en Canada. Ce qu'il en apprit il le fit connaître au public par *Le Bulletin du Parler français*. Le sentiment régionaliste s'accordait bien avec le mouvement national. Les écrits de Rivard influencèrent nombre d'écrivains, déclenchèrent en bonne mesure une action régionaliste, notamment en Mauricie et au Saguenay, et éveillèrent notre abbé Lacasse en particulier; il suffit de parcourir la table des matières de ses recueils de poésies pour s'en convaincre.

L'autre influence de Rivard sur notre poète est différente. Rivard, par des recherches et des études très poussées, devint un technicien du vers français; les conférences et les cours qu'il donna sur ce sujet étaient des modèles de science littéraire. Lacasse s'en inspire peu à peu, faisant progresser, de recueil en recueil, la qualité du rythme, la variété des mètres et la sonorité du verbe. Il s'essaya au sonnet, timidement d'abord, avec six sonnets en 1916, aucun en 1919, trois en 1927, quinze dans son Anthologie, puis enfin trente-quatre dans son dernier recueil.

L'abbé Arthur Lacasse

Voici ses œuvres : *Les Heures solitaires* (1916), *L'Envol des heures* (1919), *Les Heures sereines* (1927), *Le Défilé des heures* (1938), *L'Heure du souvenir* (1945). En 1922, il avait présenté, par son ami Camille Roy, à la Société Royale, un poème intitulé « Les Ironies de la Mort. » Admis à la Section I en 1924, il lut quelques mémoires : « Ernest Hello, le philosophe, le sociologue, le poète » (1925), « L'Abbé Apollinaire Gingras et son œuvre » (1936), « De l'influence du livre sur la formation de l'enfant » (1939), et deux pièces de vers : « A Notre-Dame du Canada » (1929) et « Ballade au soleil » (1938). N'oublions pas le sonnet offert en hommage à la Société Royale à l'occasion du cinquantenaire de cette Société. Il a aussi préfacé le recueil de vers de Charles-E. Harpe, *Les Oiseaux dans la brume* (1948).

En 1938 il pria la Société royale de mettre son nom sur la liste des membres en retraite. Il semble qu'à ce moment il ait senti les premières atteintes de l'âge. Il résolut de compiler en un seul volume le meilleur de ce qu'il avait publié dans les trois recueils précédents, et cette compilation, appelée plus haut l'Anthologie, a pour titre *Le Défilé des heures*. Il n'est pas inutile de dire que Lacasse a voulu mettre une unité dans son œuvre, en introduisant dans chaque titre le mot "heures"; cette unité n'est pas factice.

Après sa retraite il continua à rimer, et en 1945 il publiait son dernier ouvrage, *L'Heure du souvenir,* fait de pièces de circonstance : anniversaires (31 pièces), Congrès (9), hommages à des personnages (30), deuils (14). Il est probable que son exécuteur testamentaire a trouvé dans les tiroirs de M. Lacasse quantité d'autres poésies qui sont inédites.

On n'attendra pas de ce curé-poète les chants de l'amour humain, si ce n'est l'amour filial et l'amitié. Lacasse chante les sujets religieux: Dieu, le Christ, la Vierge Marie, les Saints, les Anges, le culte et les fêtes : Noël, Pâques, la Fête-Dieu, la Toussaint, les sacrements de baptême, d'ordination, de mariage, d'Eucharistie, les Cendres, le dimanche; les symboles : crucifix, hostie, calvaire, cierges.

Puis c'est la famille, qu'il célèbre : la mère, l'enfant, le berceau, la maison paternelle, le bonheur du foyer, le jardin, le pain, les étrennes, l'école, les vacances, l'horloge, la caban à sucre, les vieillards, les rentiers, le glas des défunts, le clocher du village.

Ensuite, c'est la Nature qui l'inspire le plus : les saisons, d'hiver, de printemps, d'automne, le soleil, le soir, la nuit, la mer, la pluie, le ruisseau, les orages, le vent, la source, la brume, le givre, les fleurs, les oiseaux, la chasse et la pêche.

Plusieurs séries de ses strophes sont consacrées à la Patrie : le milieu rural, le Québec, le Canada, la famille royale.

Tels sont les thèmes que lui inspire la Muse. Rien d'épique, rien du grand lyrisme, mais rien de vulgaire ni de strictement bourgeois.

Camille Roy, dans son *Histoire de la littérature canadienne,* a fait une place à Lacasse, son condisciple et son ami. Il ne le met pas dans l'école du terroir, ni dans celle des poètes artistes, mais dans le groupe occupé

de philosophie, de morale et de religion. De Lacasse il dit : « Poésie du sentiment religieux et poésie de la nature constituent le fonds essentiel de cette œuvre. Il faut y ajouter la poésie du terroir, des choses de chez nous, qui met sa note plus originale ou plus pittoresque dans l'ensemble de l'œuvre. M. Lacasse a une âme qui s'apparente avec l'âme romantique —, et il lui arrive souvent de donner au sentiment ou à ses souvenirs les formes les plus gracieuses. »

Ce jugement nous paraît fort juste. L'abbé Lacasse restera parmi les *minores*, mais parmi eux il a joué un beau rôle, et la Société Royale n'a pas à regretter de l'avoir associé à son œuvre, ni l'Université Laval de lui avoir donné un doctorat honorifique.

ARTHUR MAHEUX

Francis John Lewis

1875–1955

THE death of Francis John Lewis on May 24, 1955, marks the passing of one who was an active member of the Royal Society of Canada a few decades ago. He was elected a Fellow of the Society in 1918, and served as President of Section V during 1928-9.

Lewis came from England in 1912 to be the first Professor of Botany in the University of Alberta and remained in Canada until 1935 when he took leave of absence to occupy the chair of Botany in the Fouad I University, Cairo. He severed connection with the University of Alberta in 1937, retaining the professorship in Egypt until his retirement in 1946, when he returned to England. Still vigorous in his seventy-first year, he held a short appointment as visiting lecturer at the Royal Holloway College, University of London, and then was actively engaged in editorial and publishing work until the time of his death.

Born in London, England, in 1875, Lewis came under the influence of Thomas H. Huxley at the Imperial College of Science and Technology and turned to a career in biology. His studies were continued at the University of Liverpool where he received the degree of Doctor of Science in 1912. From 1905 to 1912 he was lecturer in geographical botany at the University of Liverpool. At that time he carried out extensive researches on the peat beds of England and Scotland, and received an award under the Cuthbert Peak Fund of the Royal Geographical Society. In 1910 he received the Neill Gold Medal of the Royal Society of Edinburgh of which he was a Fellow. He was also a Fellow of the Linnaean Society. During his stay at Liverpool, Lewis took an active interest in vegetation surveys and the newer ecological concepts. He was one of the small band of keen and enthusiastic botanists known as the Central Committee for the Survey and Study of British Vegetation, the precursor of the British Ecological Society.

As founder of the Department of Botany in the University of Alberta, Lewis soon became known as a fascinating lecturer but one who insisted on high academic standards. Though not always popular with students, he rarely failed to stimulate interest and always was challenging. He became known, too, as a champion of research. During his early years in Alberta he studied and attempted to map the vegetation of the Banff region, being associated at that period with the Canadian Alpine Club. He also carried out physiological studies related to cold resistance in native species. Later he initiated investigations of peat bogs and related vegetation in central Alberta. These and various other efforts proved somewhat frustrating because of lack of funds and insufficient personnel for such ambitious projects. Nevertheless interest was created and the way prepared for others to follow.

Concerning the work of Professor Lewis in Egypt, reference is made to an article in *Nature,* vol. 158, 1946, and to an obituary by W. Laurence

Balls and L. J. F. Brimble in *Nature*, vol. 176, 1955. Early in his sojourn there, a small laboratory was established on the Suez Road where he investigated phenomena of dew formation in the desert and studied the permeability of leaf tissues. He also undertook to investigate for the Ministry of Public Works the problem of blocking of the irrigation system of the Nile Delta through weed accumulation. As a teacher and organizer of research he appears to have achieved unqualified success at Abbassia and later at Giza, where spacious botanical laboratories were organized and important projects initiated.

Throughout his career Lewis did much to promote an interest in plant life. It was his hope that a general knowledge of earth structure and its varied plant cover might become a common possession of all educated people. Aware of the balance of nature and the dynamics of vegetation he always insisted that expert knowledge should be brought to bear upon the control of nature, pointing out the dangers of interference with natural phenomena without a scientific understanding of the factors involved. He recognized fully the importance of this knowledge in connection with forest conservation, flood control, soil use, grazing, wild life, recreation, and scenic beauty.

Lewis was an interesting and vivid conversationalist. Nor did he lack courage to speak and act in accordance with his convictions. An admirer of T. H. Huxley, he was a vigorous exponent of intellectual honesty. As a materialist of the old school, it was interesting to find him writing in 1933 as follows: "Man has become more and more aware of the strangeness and the greatness of the stage on which he plays his part."

E. H. Moss

FRANCIS JOHN LEWIS

John Patterson

1872–1955

DR. JOHN PATTERSON was born of Scottish parents in Oxford County, Ontario, on January 3, 1872, one of a family of thirteen children. He was brought up on his parents' farm and attended the local primary school, two and a half miles from his home. He attended the collegiate institutes at Ingersoll and Woodstock, Ontario. He subsequently taught public school for five years to obtain the means to pursue engineering studies. He entered the School of Practical Science, now the Faculty of Applied Science and Engineering, at the University of Toronto in 1896, and graduated in 1899 in the regular three-year course in Civil Engineering. Finding the courses not enough to occupy his energies, he also registered in the Faculty of Arts, taking the honour course in Mathematics and Physics, along with his engineering studies. During his first year, he got through the Arts course by studying the lecture notes of other students. During his fourth college year he was able to devote his whole time to his Art course so that, when he graduated, he won the Gold Medal in Physics and also the 1851 Exhibition Science Research Scholarship, being the first winner of this scholarship from Toronto. This enabled Dr. Patterson to carry on postgraduate study for two years at the Cavendish Laboratory, Cambridge University, under Sir J. J. Thomson.

In 1903 Dr. Patterson became Professor of Physics in the University of Allahabad, India, and in 1905 was appointed to the newly created position of Imperial Meteorologist for the Government of India. During this appointment he was actively interested in storm warnings of cyclones and in the public weather forecasts, which were issued only once per day. The great Indian earthquake of 1905 took place the first morning after Dr. Patterson began his meteorological duties at Simla. This led to the establishment there of a seismograph which he set up and attended.

He returned to his homeland to accept the newly created position of Meteorological Physicist in the Meteorological Service of Canada. During World War I at the request of the British Admiralty, he was loaned to them to take part in a survey being made in Canada for a source for helium. Helium was found in small quantities in gas wells in western Ontario and Alberta. Towards the end of the war, Dr. Patterson succeeded in perfecting a process for the separation of helium at a cost of about $50 per thousand cubic feet. By this time, however, the United States had come into the war and helium was produced in great quantity from the Texas gas wells so that, although the Canadian project had met with some success, it was not continued.

After World War I, Dr. Patterson returned to the Meteorological Service, continuing his earlier investigations on the upper atmosphere. He modified the Dines meteorograph for Canadian use so that the pen was lifted off the silvered plate on the downward fall of the equipment just a few

hundred feet before the meteorograph struck the ground. Prior to this time, part of the upper air record had often been lost because the pen smudged the trace when the instrument bounced on striking the ground. Dr. Patterson also developed the Canadian pilot balloon programme and devised a simple procedure for computing the velocity of the upper winds from the flight observations.

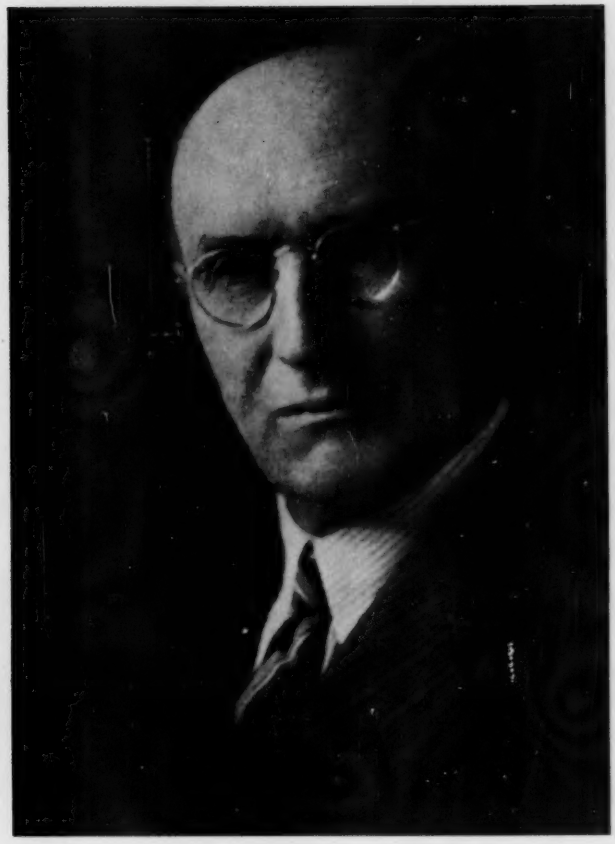
Dr. Patterson was interested mostly in wind and pressure instruments. He will perhaps be best known for his development of the three-cup anemometer which he originated and which, he was able to show, had definite superiority over the four-cup type. He also made intensive studies along with others at this time on improving the anemometer by beading the edge of the cup and changing the shape from a hemisphere to a cone with a straight lip. Later on, he developed a satisfactory electromagnetic anemograph for recording wind speed and direction.

Until thirty-five years ago, 75 per cent of the mercury barometers shipped to Canada arrived in a broken condition, with the metal parts contaminated by mercury. Shortly after World War I, Dr. Patterson decided to design a barometer for manufacture in Canada, which would combine the advantages of a Kew barometer with the portability of the Fortin barometer. This instrument, now known as the Patterson barometer, can be shipped to any weather station in Canada with little risk of breakage. He also developed an almost automatic procedure for filling barometer tubes with pure mercury, a method still in use today, in which the boiling of mercury is eliminated and there is no possibility of breaking the barometer tube.

Dr. Patterson was appointed Assistant Director of the Meteorological Service in 1924 and Director in 1929 (the title being changed in 1936 to Controller). As Director, or Controller, he was responsible for modernizing the Service and encouraging the introduction of the latest developments in all branches of meteorology. He organized meteorological services for Trans-Canada Air Lines and for the Canadian side of Trans-Atlantic aviation, and, with the outbreak of the Second World War, for the Royal Canadian Air Force. He retired from his official position on December 1, 1946.

Dr. Patterson was elected a Fellow of the Royal Society of Canada in 1918 and for over thirty years actively participated in the administration of the Society's activities. He was Secretary of the Royal Society, 1921-35; Honorary Editor, Royal Society *Transactions*, 1923-39; Chairman, Publications Committee, 1920–5 and President, Section III, 1936–7.

In his early years in office, Dr. Patterson had much to do with breaking down the practice of holding all the Society's meetings in Ottawa. He worked hard as Chairman of the Publications Committee to make the *Transactions* a satisfactory means for the publication of scientific research done in Canada. To do this, the procedure of publishing all the Sections of the *Transactions* in one volume was changed so that each of the five sections now publishes its *Transactions* separately. Previously, the annual *Transactions* had to wait until the last paper from any of the Sections had been received.



JOHN PATTERSON

Dr. Patterson's wisdom was greatly respected in international meteorology and he represented Canada in numerous conferences and committees. He was President of the Commonwealth Conference of Meteorology in London, England, in 1935, and was President of the W.M.O. Technical Commission on Instruments and Methods of Observation, 1946-53. Dr. Patterson was President of the American Meteorological Society from 1930 to 1932 and an Honorary Member of both the Royal Meteorological Society and the American Meteorological Society.

A very happy event in India for Dr. Patterson was his marriage to Margaret Norris, M.D., born at Staffa, Perth County, Ontario, who had gone out as a medical missionary and was in charge of the Seward Hospital of the American Presbyterian Mission at Allahabad. For fifty years Mrs. Patterson created an ideal home life for her husband and the guests at their hospitable table will long remember her ready wit. For twelve years she was a Police Magistrate in Toronto.

Dr. Patterson belonged to the Presbyterian Church (later the United Church of Canada) and took an active part in the congregation to which he belonged, carrying out his duties as an elder and faithfully attending its services. His religious faith pervaded his daily life and gave him a quiet tenacity of purpose that carried him triumphantly through frequent periods of delay and disappointment. Dr. Patterson was a non-smoker and was strongly opposed to the drinking of alcohol.

For a few years prior to the Second World War, he was a member of a curling club and devoted the one evening a week he felt he could spare from his office work to playing on a team. Dr. Patterson obtained his greatest pleasure in his work. He loved designing instruments and carrying out his administrative duties. Fortunately, he had a strong constitution so that he was able to work for ten or twelve hours a day for many years without taking sick leave or the authorized annual holiday. After his retirement from official duties, he continued to come to the office daily and carried on his writing and instrument work until six weeks before his death.

Dr. Patterson made a notable contribution to the advancement of meteorology in Canada and abroad by his untiring energy, his sound judgment, and the integrity of his character.

ANDREW THOMSON

Bruce Rose

1890–1956

BRUCE ROSE had been a member of the Royal Society of Canada since 1927 and was President of Section IV for 1946–7. He was born on a farm at Mountain, Ontario, about thirty-five miles south of Ottawa. Both his father and his mother were born near Ottawa; his grandparents on his father's side migrated from Perth in Scotland, and on his mother's side from the north of Ireland. He was therefore raised in a pioneer farm home and knew well the struggle for a good education.

He attended elementary schools near home, and then went to high school at Kempville, Ontario, about twelve miles away. Bruce was the youngest of seven children and his father died when he was only a year old. His mother then rented the farm on shares, and managed to keep Bruce at school till he matriculated.

His ambition was to study architecture but there was no such course available for him, so he started teaching school in the Cornwall district of Ontario. Despite the low salaries of those days he saved enough in three years to enter the University of Toronto for a course in Civil Engineering.

At Toronto he had a cousin who was coming to Queen's University at Kingston, Ontario, for a course in Mining Engineering, so Bruce Rose decided to accompany him to Kingston. After two months at Queen's University he changed to the course in Geology and Mineralogy as he developed a great fondness for this type of work. The late Dr. R. W. Brock was then Professor of Geology at Queen's University, and it is little wonder that Bruce Rose caught some of his enthusiasm for Geology. In 1907 Dr. Brock became director of the Canadian Geological Survey, and the writer was appointed acting head of the Geological Department at Queen's University; he cannot recall a more diligent, more honest, more modest and reliable student than Bruce Rose. He was graduated Bachelor of Science in 1909 and after spending one year as assistant in Geology he proceeded to Yale University and received his Ph.D. in stratigraphic geology in 1913.

Bruce Rose was one of a rather remarkable group of men both at Queen's University and at Yale, men whose names are familiar to fellows of the Royal Society, for example, Dr. E. L. Bruce; Dr. A. M. Bateman; Dr. N. L. Bowen; Dr. M. Y. Williams; Dr. W. C. Clarke; Dr. J. J. O'Neill (Past President of the Royal Society); and Dr. W. A. Mackintosh (President).

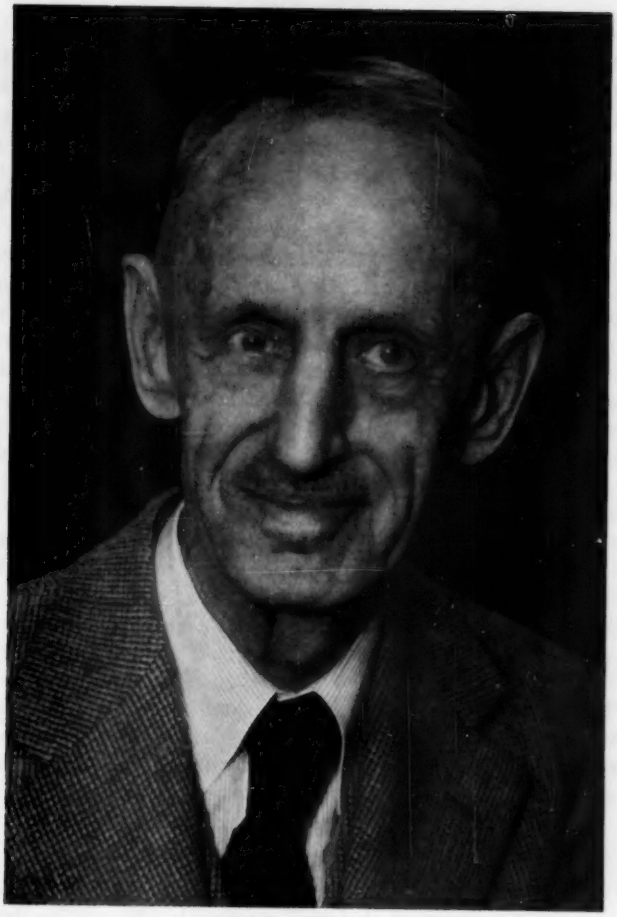
Upon completion of his studies at Yale University in 1913, he joined the Canadian Geological Survey staff, and spent the next seven years in field work. The first two years were in south Saskatchewan on the lignite possibilities of that area. The next five years were spent in the coal fields of the Crow's Nest Pass on both the Albertan and British Columbian sections. Early in 1920 he resigned from the Canadian Survey and joined the field staff of the Whitehall Petroleum Corporation. He first did some

reconnaissance work in Alberta, and then was sent by the same company to the Assam district in India, where he did field work for one year.

In 1922 he returned to Canada and joined the staff of Queen's University as Assistant Professor in Geology. He found it a large task to get back to teaching, but he was a real success, and by intensive work he advanced from Assistant to Associate Professor, then to full Professor and finally Head of the Department in 1949. By 1953 he found the work too difficult and trying. He was then sixty-three years of age and had served Queen's as a teacher for thirty-one years.

Dr. Rose had one daughter and one son, both of whom were married; he himself was a widower and lived alone in Kingston. His son Kenneth, an M.Sc. of Queen's University, is Geologist for the Madsen Red Lake Gold Mine; he and his family were on a visit to the scenes of Dr. Rose's childhood, when the car skidded. Dr. Rose was thrown from the car-door and apparently was killed instantly. Fortunately no one else in the car was injured.

M. B. Baker



Bruce Rose

Georges Bouchard

1888–1956

LE 3 août, à Québec, mourut Georges Bouchard, né en 1888, à St-Philippe-de-Néri, comté de Kamouraska. Il fit ses études au village natal, au collège classique de Ste-Anne-de-la-Pocatière, puis aux Universités Laval, Louvain, Angers et Cornell.

Il fut ingénieur agricole, Docteur *honoris causa* de Laval et membre de la Société Royale du Canada. Durant l'année 1941–1942, il présida la Section des Humanités et des Sciences sociales.

Agronome et professeur d'agriculture au moment où la compétence dans la culture des champs devint chez nous une préoccupation, puis un programme, Georges Bouchard, vers 1912, prit une part active au mouvement qui devait, avec le temps, élargir nos horizons agricoles.

A l'Ecole d'Agriculture de Ste-Anne-de-la-Pocatière, où il enseignait durant plusieurs années, il fut non seulement un semeur de connaissances agricoles, mais aussi un animateur de tous les mouvements propres à faire aimer la terre, puis à donner aux terriens conscience de leur valeur sociale parmi les autres classes de la société.

Avec ses compagnons de travail, qui constituaient une élite agronomique précieuse, Georges Bouchard multipliait les initiatives favorisant l'instruction agricole et la formation d'un esprit généralement plus favorable à l'agriculture.

Représentant du comté de Kamouraska à la Chambre des Communes pendant dix-huit années, puis sous-ministre fédéral de l'agriculture durant quinze ans, il s'occupa très activement des problèmes agricoles, non seulement au Parlement, mais dans tous les milieux où son prestige d'homme public, sa personnalité agréable et ses connaissances variées pouvaient servir la cause de l'Agriculture, celle du Canada français et celle de son pays, trois causes envers lesquelles, du commencement à la fin de sa carrière, sa fidélité se montra toujours indéfectible.

*

Par sa vie publique et privée, par sa plume et par ses discours, Georges Bouchard eut le mérite d'incarner l'idéal de la noblesse terrienne.

Ainsi, par exemple, Georges Bouchard n'a jamais laissé passer une occasion de protester contre le mot « paysan », dont plusieurs se servent pour désigner les cultivateurs de chez nous, parce qu'il considérait nos cultivateurs comme de grands seigneurs, nullement comparables, par leur situation sociale, à ceux que l'on appelle, en Europe, les paysans.

Même quand ils ne participaient pas à ce débat linguistique et sociologique, tous ont admiré, chaque fois, la conviction et la véhémence avec lesquelles Georges Bouchard soutenait contre tout venant la thèse qui place l' « habitant » québecois au-dessus du paysan européen, dans la hiérarchie sociale universelle.

A défendre les valeurs morales de l'agriculture et les richesses de notre patrimoine ancestral, il a mis son talent, le charme de sa personne, sa puissance d'observation psychologique, son sens esthétique et sa soif de poésie.

A la cage étroite d'une versification parfois meurtrissante pour la pensée, la poésie de Georges Bouchard préférait les vastes espaces et la liberté d'une prose aussi musicale et ciselée que possible.

Son volume, *Vieilles Choses, vieilles gens*, eut les honneurs d'une traduction anglaise et prit place dans un grand nombre de bibliothèques même en dehors du Québec.

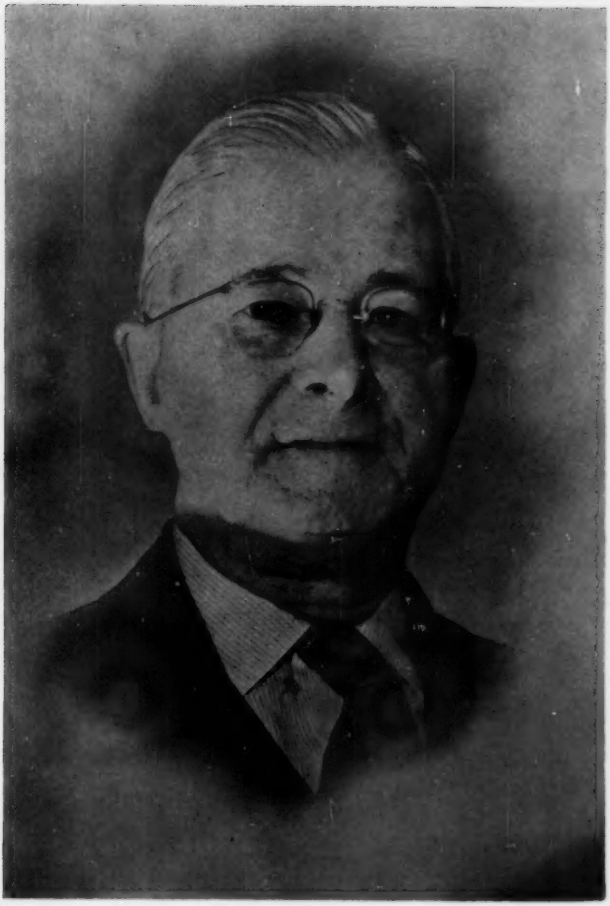
Quelqu'un a dit de lui qu'il était, « en plein vingtième siècle, un homme oublié par le dix-neuvième, avec ce souci du perfectionnement personnel, avec ce goût de vivre et cet attachement sentimental, mais profond, à la poésie de la terre, à tout art paysan. »

Georges Bouchard avait, en effet, le souci de se perfectionner indéfiniment. Voilà une préoccupation que l'on ne rencontre pas trop souvent chez nous, aujourd'hui, et qui est pourtant fort louable.

A la Société Royale du Canada, l'an dernier, on l'a vu savourer par anticipation sa joie de pouvoir bientôt, probablement au pays de ses pères, consacrer le soir de sa vie à parler des gens et des choses qu'il n'a jamais cessé d'aimer et de servir avec la sincérité la plus édifiante.

Le Souverain Maître en ayant décidé autrement, notre vœu le plus ardent, c'est que le mérite de toutes ces œuvres projetées s'ajoute Là-Haut à celui des œuvres accomplies par ce personnage sympathique et utile que fut Georges Bouchard pour l'agriculture et à la société canadienne.

EUGÈNE L'HEUREUX



GEORGES BOUCHARD

APPENDIX C

TITLES AND ABSTRACTS OF PAPERS PRESENTED AT THE ANNUAL MEETING

PROGRAMME OF PAPERS

«‹-›»«‹-›»

SECTION I. LITTÉRATURE, HISTOIRE, SCIENCES SOCIALES, ETC.

1. Quatre écoles royales (1820–1836) : Sainte-Marie de la Nouvelle-Beauce; Portneuf; Cap-Santé; Sainte-Anne du Sud. Par Louis-Philippe Audet. Présenté par Arthur Maheux, M.S.R.C.

Le 8 avril 1801, le lieutenant-gouverneur du Bas-Canada, Robert Shore Milnes, sanctionnait la loi 41 Geo. III, ch. 17 qui établissait un organisme resté fameux, l'Institution Royale pour l'avancement des Sciences. La plupart des historiens ont affirmé que cette institution avait pour but d'angliciser et de protestantiser les Canadiens français. Tout en reconnaissant que cette intention n'était peut-être pas totalement absente des préoccupations de Jacob Mountain, de Jonathan Sewell et d'Herman Witsius Ryland, il faut admettre que les initiatives du Bureau de l'Institution royale, à partir de sa formation en 1818, furent bien différentes de ces visées pour le moins alarmantes : les procès-verbaux et la correspondance de l'Institution l'établissent péremptoirement.

Une douzaine de paroisses canadiennes-françaises acceptèrent les écoles royales créées par cette loi de 1801. A la lumière des documents d'archives que nous avons trouvés à l'université McGill, il nous semble utile de faire revivre quatre d'entre elles : ce sont les écoles royales de Sainte-Marie de la Nouvelle-Beauce, de Portneuf, de Cap-Santé et de Sainte-Anne du Sud (la Pocatière). Cette étude nous permettra de mieux connaître les dispositions de notre première loi scolaire, les modalités de son fonctionnement, la qualité des maîtres, la valeur des manuels alors en usage, bref les problèmes que durent surmonter les protagonistes de l'éducation élémentaire officielle de 1820 à 1836.

2. Un nouveau dictionnaire canadien anglais-français, français-anglais. Par Pierre Daviault, M.S.R.C.

Un grand éditeur de Toronto a confié à trois spécialistes des questions de langue le soin d'établir un dictionnaire d'usage et de traduction, qui tiendra compte de toutes les particularités linguistiques du Canada, aussi bien en anglais qu'en français, pour combler une lacune que laissent les dictionnaires européens, les seuls en somme qui servent dans le domaine de la traduction.

3. D'une conque marine, noir et or: Journées de fièvre dans les Flandres. Par Maurice Hébert, M.S.R.C.

Prélude; Chant des dix journées; Postlude.

4. Pierre Roubaud, imposteur, faussaire et espion. Par Gustave Lanctot, M.S.R.C.

Ce fils d'un catholique et d'une protestante mêlait étrangement de grandes qualités à de considérables défauts. Admis, non sans de sérieuses inquiétudes de ses supérieurs dans la Compagnie de Jésus, il débute au Canada, en 1756, comme missionnaire des Abenaquis à Saint-François-du-Lac. Au cours de la guerre de Sept Ans, il tombe dans l'inconduite morale

et, répudié par son ordre, passe comme informateur au service du gouverneur Murray. Bientôt forcé de quitter le pays, il se rend à Londres, avec une lettre du gouverneur, qui lui ouvre la porte des ministères désireux de renseignements. Car l'homme possède d'exceptionnels talents : une plume excellente, une information remarquable, une intelligence méthodique et une imagination inépuisable. Il rédige des mémoires pour le cabinet de Westminster, sur les affaires du pays, et dénonce l'église et les communautés religieuses. Dans l'entre-temps, il mène une vie de basses débauches, qui le conduisent aux expédients douteux et à la prison pour dettes. En 1758, il fabrique de fausses lettres de Montcalm, où il lui fait prédire la rébellion des colonies américaines en révolte à ce moment contre les impôts britanniques. Après différents avatars, il fait de l'espionnage pour le compte de l'Angleterre, tout en travaillant au service de l'ambassade de France et plus tard de l'Espagne. Il vivote ainsi de ce métier interlope. En 1783, il devient le secrétaire du fourbe Pierre Du Calvet, dont il met en style littéraire les mensonges et les élucubrations, dont il communique les projets au ministère. Il continue, cependant, de fabriquer des mémoires pour le gouvernement jusqu'au jour où, ayant épuisé ses ressources d'imagination, il tombe dans une abjecte pauvreté. Finalement, il passe en France, où il meurt, en 1791, après une tardive réconciliation avec l'église.

5. État des études sur le romantisme littéraire canadien: A la recherche du visage romantique canadien. Par le professeur Arsène Lauzière, docteur de l'Université de Paris. Présenté par Pierre Daviault, M.S.R.C.

(1) Visage révélé :

- (*a*) Bilan des travaux accomplis
- (*b*) Appréciation sommaire de ces travaux
- (*c*) Déficiences :
  - A. quant à l'origine du romantisme
  - B. quant à la nature : (i) pauvreté des traits;
    (ii) obscurité des traits

(2) Visage non révélé :

- (*a*) l'origine : où, quand et comment
- (*b*) la nature : revue des principaux thèmes romantiques français et canadiens
  Principes et réalisations

(3) Le problème à résoudre : Y a-t-il eu un véritable romantisme au Canada ? L'imitation : masque ou visage ? Romantisme ou pararomantisme ?

6. Étude de sémantique combinatoire. Par Jean-Marie Laurence, M.S.R.C.

L'interaction du sens de base et du sens contextuel des mots joue un rôle prépondérant dans la vie du langage. — Pour manier correctement une langue et comprendre son évolution, il importe de distinguer d'abord avec précision le contexte situationnel et le contexte littéral; il faut distinguer ensuite le contexte littéral mobile et le contexte littéral figé. — Dans le contexte mobile, l'indication du degré de cohérence des éléments contextuels permet de résoudre une foule de problèmes syntaxiques qui échappent à la linguistique structurale. — Ainsi, la sémantique combinatoire ouvre des horizons nouveaux sur la vie du langage et fournit une méthode féconde à la grammaire normative.

7. De la Médée d'Euripide à la Médée d'Anouilh. Par Maurice Lebel, M.S.R.C.

Le sujet d'Euripide. Médée est un monstre par nature; l'animalité du personnage. La *Médée* de Sénèque. La tragédie de Corneille. La célèbre trilogie de Grillparzer : *L'Hôte, Les Argonautes, Médée.* Tragédie poétique de Grillparzer. Reprise du thème de Médée dans la pièce de Lenormand, *Asie.* La tragédie américaine de Robinson Jeffers. L'étrange version d'Anouilh.

8. Alfred de Vigny et l'antiquité grecque. Par Maurice Lebel, M.S.R.C.

Quelle idée les hommes de la révolution et de l'Empire (1789–1815) se faisaient-ils de la Grèce ? Formation de Vigny, nourri de Racine et de Chénier, traducteur d'Homère et lecteur de Platon. Idées grecques chères à Vigny. Influence du stoïcisme antique. Influence des écrivains suivants : Homère, Eschyle, Platon, Théocrite, Julien, saint Jean Chrysostome. De tous les poètes romantiques français, Vigny est celui qui a le mieux compris et le plus goûté la Grèce.

9. Le retour de Jean-Baptiste Meilleur au Canada. Par Léon Lortie, M.S.R.C.

En 1826, Jean-Baptiste Meilleur revient au Canada après avoir fait ses études de médecine aux Etats-Unis. Il a été témoin des efforts consentis par les citoyens de la Nouvelle-Angleterre pour la construction de leurs écoles et il désire inspirer un zèle pareil à ses compatriotes. En même temps qu'il pratique sa profession et qu'il collabore aux journaux et revues auxquels il adresse des articles sur des sujets scientifiques, il entreprend une polémique au sujet des écoles et des collèges. Afin de susciter plus d'intérêt il polémique apparemment avec lui-même dans les lettres qu'il signe de pseudonymes différents. Ces lettres jettent un jour nouveau sur l'état de l'éducation dans le Bas-Canada entre 1826 et 1830 et sur l'intention qu'avait Meilleur de fonder un collège à l'Assomption.

10. Un Pierre Bédard inconnu. Par Arthur Maheux, M.S.R.C.

On connaît Pierre Bédard comme patriote et comme juge. Il fut aussi un philosophe et un savant. La preuve s'en trouve dans un manuscrit de lui conservé aux archives du Séminaire de Québec. C'est un grand cahier de plus de cinq cents pages, entièrement écrit de sa main. Bédard y discute des questions de logique, de dialectique, de morale, de jurisprudence, de sciences, de musique, de grammaire. Il conclut ordinairement ses argumentation par une formule mathématique. A l'occasion on trouve des notes de caractère politique : listes d'électeurs, etc. C'est un aspect inconnu de la vie de ce personnage.

11. Un tour pendable. Par Adrien Plouffe, M.S.R.C.

Un rentier immensément riche, mais qui n'a rien d'un nouveau riche car il ne manque pas d'esprit, joue un tour à un voisin indélicat qui lui volait son journal tous les matins. Cependant, ce tour inoffensif devient, grâce aux circonstances, un tour pendable.

Section I

12. Quand les fées s'en mêlent. Par Adrien Plouffe, M.S.R.C.

La fée Good-Lucka, déléguée sur la terre par le Bon Dieu, à la demande d'Abraham Lincoln, résout à sa façon la question de la ségrégation raciale aux Etats-Unis. Un conte fantaisiste et satirique qui est de nature à dessiller les yeux des Blancs du Sud qui persistent encore à se croire les seuls tenants de la civilisation américaine en 1956.

13. Joyce Roosmalen et ses recherches au Canada. Par Adrien Plouffe, M.S.R.C.

Confidences d'une jeune Américaine millionnaire qui se livre à d'ahurissantes recherches au Canada. Etrangère et anglicane, elle peut avoir son franc-parler et elle ne se gêne pas pour dire ce qu'elle pense avec le sourire d'une femme cultivée. Sa critique est constructive, mais ne laissera pas de soulever des discussions. L'auteur affirme qu'il s'agit seulement d'une œuvre dictée par l'imagination. Mais l'imagination est-elle toujours la folle du logis ?

SECTION II. ENGLISH LITERATURE, PHILOSOPHY, SOCIAL SCIENCES, ETC.

Monday, June 11

11.00 A.M.—Presidential Address: The Existential Philosophy.
By J. S. Thomson, F.R.S.C.

2.00 P.M.

1. Business Meeting.

2. General Session on Canadian Literature

(1) The Canadian Writer and His Public, 1882–1953. By Desmond Pacey, F.R.S.C.

In his Inaugural Address as first president of the Royal Society of Canada in 1882, Dr. J. W. Dawson said in part: "We meet today to inaugurate a new era in the progress of Canadian literature and science." This paper seeks to trace and evaluate the progress of Canadian literature in the intervening seventy years. An effort is made to relate this progress to the political, social and economic conditions of the country. There is also some discussion of the role which the Royal Society has played in our literary development, and of possible further measures which it might undertake.

(2) Preface to an Uncollected Anthology. By H. N. Frye, F.R.S.C.

The author imagines that he has collected his own ideal anthology of English Canadian poetry, with no difficulties about permissions, publishers, or expense, and is writing his preface.

(3) Religious Sensibility in Canadian Fiction. By Roy Daniells, F.R.S.C.

It is generally assumed that Canadian fiction (in English) is so predominantly secular in character as not to be responsive to critical examination by religious categories. Religious sensibility, however—as distinct from religious doctrine—has in fact had a strong influence on choice of subjects, on point of view, and on style. Ralph Connor, Susanna Moodie, Hugh MacLennan, Morley Callaghan, Ethel Wilson and others provide points of reference from which not only differences among types of sensibility but also the evolution of given sensibilities may be charted.

Tuesday, June 12

9.30 A.M.—Symposium with Sections I and V

Panel Discussion: Foreign Languages and the Progress of Literature and the Sciences.

Discussants: Pierre Dansereau, F.R.S.C.
H. Alexander, F.R.S.C.
J. C. Falardeau, M.S.R.C.
C. P. Leblond, F.R.S.C.

The panel will open an inquiry into the degree of necessity of direct access to documents in other languages for various categories of intellectual workers.

Section II

2.00 P.M.—General Session, Social Sciences

(1) Some Reflections on the Classical Literature of Political Economy. By V. W. Bladen, F.R.S.C.

(2) British Parties and Political Ideas. By A. Brady, F.R.S.C.

This paper examines the extent to which the two leading British parties represent distinct political ideas. On the basis of this examination, extending over the last half century, some broad generalizations are attempted on the role of parties in a democratic state such as Britain.

Wednesday, June 13

9.30 A.M.—Round Tables.

1. (1) Progress and Evolution, by T. A. Goudge, F.R.S.C.

The paper presents an analysis of the idea of progress, with special reference to its use in recent formulations of the theory of evolution. It is argued that "progress" can be defined in terms which avoid the extravagances of nineteenth-century versions of the idea. Its descriptive and normative aspects are distinguished; and in the light of this an examnation is made of certain attempts to ascribe progress to the evolution of living things on the earth during the past two thousand million years. Some of the philosophical implications of these attempts, for our understanding both of "progress" and of "evolution," are then indicated.

(2) The Effect on Biblical Studies of the Qumran Scroll Discoveries. By R. B. Y. Scott, F.R.S.C.

The paper will first outline the nature and extent of the Qumran finds which have a bearing on Biblical studies. It will estimate their importance in the light of various views expressed up to the present by representative scholars. A discussion will follow of the new evidence for the textual history of the Old Testament. Finally, the question will be raised of the relationship to primitive Christianity of the Qumran Sect.

2. (1) A Greek Literary Critic: Dionysius of Halicarnassus. By G. M. A. Grube, F.R.S.C.

The critical works of Dionysius of Halicarnassus make up the bulk of the critical texts we possess in Greek from Aristotle to Quintilian. We know he lived in Rome between 30 and 8 B.C., whereas the other important works cannot be dated with any certainty within two centuries or more. He is not, like Aristotle, a philosopher; he is not, like Longinus, a critical genius, but he is a cultured and intelligent writer and man of letters in whose considerable works we can study, as nowhere else, the methods of post-Aristotelian criticism. The purpose of this paper is to review those methods and to evaluate the place of Dionysius in the history of literary criticism.

(2) Goethe in his Letters. By Barker Fairley, F.R.S.C.

The Goethe letters are not the best known part of his work. The mere bulk of them—14,000 or so in all—is forbidding. Yet they are of great importance and in many ways indispensable. It is possible to read *Faust* and feel compelled to ask whether Goethe was shifting his ground at the end. The letters of his last years give the answer. This is one reason for reading them and there are many others. Nowhere else in his writings do we find such interesting parallels between his time and ours.

(3) Plato's Aesthetic Reconsidered. By F. H. Anderson, F.R.S.C.

An examination of certain of Plato's writings in disproof of two contentions: first, that his aesthetic is ethical in design, and secondly, that such recognition as he gives to poetry and other fine arts is rendered nugatory by a transcendental metaphysics.

(4) What is a Field? By F. G. Roe. Presented by F. M. Salter, F.R.S.C.

This paper attempts to discover the actual meaning of the Old English word *feld*. Was it, like *veldt* in South Africa or *prairie* in North America, a widely comprehensive term, or did it have a restricted meaning? The evidence brought to bear upon the problem in this paper consists of place-names, manorial customs, and comparative data of several kinds.

2.00 P.M.—Business Meeting.

SECTION III. MATHEMATICAL, CHEMICAL AND PHYSICAL SCIENCES

Summary of Programme

Monday, June 11

11.00 A.M. General Meeting of Section, Room O'425.
2.00 P.M. Presidential Address and invited papers, Room O'425.

Tuesday, June 12. Sub-section meetings as follows:

9.00 A.M. Mathematics, papers 3–11, Room O'425.
9.00 A.M. Chemistry, papers 26–36, Room B'425.
9.00 A.M. Nuclear Physics, papers 61–69, Room A'425.
9.00 A.M. General Physics, papers 77–86, Room A'406.
2.00 P.M. Mathematics, papers 12–19, Room O'425.
2.00 P.M. Solid State and Spectroscopy, papers 45–53, Room B'425.
2.00 P.M. Nuclear Physics, papers 70–76, Room A'425.
2.00 P.M. General Physics, papers 87–94, Room A'406.

Wednesday, June 13. Sub-section meetings as follows:

9.00 A.M. Mathematics, papers 20–25, Room O'425.
9.00 A.M. Chemistry, papers 37–44, Room B'425.
9.00 A.M. Meteorology, papers 54–60, Room A'425.
9.00 A.M. General Physics, papers 95–100, Room A'406.
12.00 A.M. Business Meeting of Section, Room O'425.

Monday, June 11

11.00 a.m.—Business Meeting of Section, Room O'425.

2.00 p.m.—Presidential Address and invited papers, Room O'425.

1. Perspectives towards the Future in Physics. W. H. Watson, F.R.S.C.
2. International Geophysical Year Programme. F. T. Davies, F.R.S.C.

MATHEMATICS

Tuesday, 9.00 a.m. Papers 3–11.

3. The Second Boundary Value Problem for the Wave Equation. By G. F. D. Duff. Presented by G. de B. Robinson, F.R.S.C.

Mixed problems for hyperbolic equations involve initial and boundary conditions on spacelike and timelike surfaces respectively. An existence theorem is found for N variables when the boundary condition contains a directional derivative of the solution, the direction being not tangent to a certain family of characteristic surfaces. The differentiability of the solution is governed by the number of compatibility conditions satisfied by the data at the intersection of the two surfaces. This theory has been extended to systems of linear hyperbolic equations with similar principal part and then applied to the equations of harmonic tensors and electromagnetic fields.

4. Rings Determined by the Group of Units in the Ring. By I. Halperin, F.R.S.C.

Let R be a ring with an element l such that $al = la = a$ for all a in R. Call x a unit if $xy = yx = l$ for some y. The set of units in R form a group G. For certain rings R, the ring R is essentially determined by its group G. R. Baer first showed this when R is the ring of endomorphisms of a vector module over a field; G. Ehrlich and E. Whitesitt have varied Baer's method to apply to other rings. We now give a general discussion which includes these more special cases.

5. Coordinates for Geometries of Order Three or More. By K. D. Fryer and Israel Halperin, F.R.S.C.

We consider again the theorem of J. von Neumann, that coordinates can be introduced into any complemented modular lattice of order four or more. We simplify our previous proof of this theorem, and we give additional axioms under which our proof applies to complemented modular lattices of order three (the new axioms play the role of Desargues' Theorem in projective geometry).

6. The Fundamental Equations of a Subspace of a Conformally Euclidean Space. By Richard Blum. Presented by Peter Scherk, F.R.S.C.

Based on the result of a previous paper the fundamental equations of a V_n in a C_N are determined in their explicit form. The cases for which the "conform-class" $\nu = N - n = 1$, 2, or $\geqslant 3$ are separately discussed.

7. The Groups of the Regular Complex Polygons. By H. S. M. Coxeter, F.R.S.C.

In the affine plane with a unitary metric, a regular complex polygon $l(g)m$ is a configuration of g/m points lying in sets of l on g/l lines, in such a way that two unitary reflections, R and S, cyclically permute the l points on one line and the m lines through one point. G. C. Shephard (Proc. London Math. Soc. (3), **2**, 1952: 82–97) enumerated these configurations and found complicated defining relations for the groups generated by R and S. These relations have now been considerably simplified. In particular, if $l^{-1} + m^{-1} + n^{-1} - 1 = q > 0$, the relations

$$R^l = S^m = E, \ (RS)^n = (SR)^n$$

define a group of order $g = 4/nq^2$ (W. O. J. Moser, Proc. Roy. Soc. Can. III, 1955: Appendix C, p. 23) which is the group of the polygon $l(g)m$.

8. Constructions in Hyperbolic Geometry. By Frans Handest. Presented by H. S. M. Coxeter, F.R.S.C.

All the constructions in hyperbolic geometry that can be performed by means of a ruler and a compass for drawing either a circle or a hypercycle or a horocycle can be performed using a parallel ruler. The same constructions can be performed by means of a ruler alone if there is drawn somewhere in the plane one of the cycles with centre or axis and two parallel lines with a common end not on the axis. A corollary shows that a fixed adjustment of the compasses is no restriction. Finally there is shown a construction for the common perpendicular line to two skew lines in hyperbolic 3-space.

9. A Generalization of the Racah Coefficient. By W. T. Sharp. Presented by L. G. Elliott, F.R.S.C.

A compact topological group G is "simply reducible" (E. P. Wigner, Am. J. Math. *63*(1941): 57) if no (unitary) irreducible constituent $D^{(j)}$, $j \epsilon M$ say, of the direct product of two irreducible representations occurs more than once. The associativity of the direct product implies that corresponding to G there exists an invariant function, the "Racah coefficient," defined on M^6 in terms of the Clebsch-Gordan coefficients for G. In terms of this Racah coefficient we define certain "$3n\,j$ symbols," functions of $3n$ elements of M (n integer) and obtain symmetry orthogonality and recursion relations which are generalizations of formulae derived by Racah for the case $n = 2$ and G the three-dimensional rotation group.

10. On the Mathematics of Sentence Structure. By J. Lambek. Presented by W. L. G. Williams, F.R.S.C.

A theory of syntactic types (parts of speech) is developed, following Ajdukiewicz and Bar-Hillel. These types form a group-like algebraic system, with two generators s and n, the types of sentences and nouns respectively. Given the types of all words in a text, the type of a compound phrase is computed by multiplication. This offers an effective method for testing whether strings of words are sentences, such as "John(n) likes ($n\backslash s/n$) fresh(n/n) milk(n)." Pronouns differ in type from nouns, articles from adjectives. Case distinction is provided for; but the categories of tense and number require 4 generating types instead of 2.

11. Certain Infinite Zero-Sum Two-Person Games. By A. L. Dulmage and J. E. L. Peck. Presented by Israel Halperin, F.R.S.C.

The game (I, J, K) consists of two sets I and J and a real function K on the product set $I \times J$. If the maximising player chooses $i \epsilon I$ and the minimising player chooses $j \epsilon J$ then the former receives $K(i, j)$ from the latter. If the value of the game to the maximising player is less than the value of the game to the minimising player, the game is called admissible. If the game (I, J, K) is admissible and if, for each $j \epsilon J$, there exists a real number

$$L_j = \inf_i K(i, j) = \lim_i K(i, j),$$

then the game has a value $v < +\infty$ and the maximising player has an optimal strategy.

Tuesday, 2.00 p.m. Papers 12–19.

12. The Riesz-Fischer Completeness Theorem for Function Spaces and Vector Lattices. By Israel Halperin, F.R.S.C., and W. A. J. Luxemburg.

The modern lattice-theoretic proof of the Riesz-Fischer theorem applies, under suitable hypotheses on the norm, to (i) normed function spaces and (ii) normed vector lattices. We give a unified discussion which includes both the above special cases and we determine suitable hypotheses on the norm which are necessary as well as sufficient (the hypotheses usually stated are shown to be unnecessarily strong).

13. Reflexitivity of the Length Function. By Israel Halperin, F.R.S.C., and W. A. J. Luxemburg.

Function spaces L^{λ}, previously introduced by Ellis and Halperin, are Banach spaces under a norm $\lambda(f) = \lambda(|f|)$. Here the length function $\lambda(u)$ is assumed to be a non-negative function, defined for all non-negative $u(P)$ which are measurable on a given measure space S. The conjugate length function λ^* was defined by: $\lambda^*(v) = \sup \int uv$ for all u with $\lambda(u) \leqslant 1$. We show that λ^{**} may fail to be identical with λ under certain pathological conditions (which we describe explicitly). Otherwise, as we show, $\lambda^{**} = \lambda$.

14. Some Applications of Mellin Transforms to the Theory of Bivariate Statistical Distributions. By Charles Fox. Presented by W. L. G. Williams, F.R.S.C.

If
$$F(r, s) = \int_0^{\infty} \int_0^{\infty} f(x, y)\, x^{r-1} y^{s-1} dx\, dy$$

then $F(r, s)$ is the double Mellin transform of $f(x, y)$. This can be inverted to

$$(1) \qquad f(x, y) = \frac{1}{(2\pi i)^2} \int_{h-i\infty}^{h+i\infty} \int_{k-i\infty}^{k+i\infty} F(r, s)\, x^{-r} y^{-s} dr\, ds.$$

I prove the following results: let (ξ, η) be a pair of random vibariate variables with frequency function $f(x, y)$, assumed symmetrical about the x and y axes. Then $E(|\xi|^{r-1} |\eta|^{s-1}) = 4 F(r, s)$, where E is the expectation function. Hence, if the expectation function is known we can, by (1), compute the frequency function. If (ξ_1, η_1) and (ξ_2, η_2) are two pairs of bivariate random variables (with symmetrical frequency functions) then the frequency function of the pair $(\xi_1, \xi_2, \eta_1, \eta_2)$ has Mellin transform $4 F_1(r, s) F_2(r, s)$ where $F_1(r, s)$ is the Mellin transform of the frequency function of (ξ_1, η_1) and $F_2(r, s)$ is that of (ξ_2, η_2). Thus, on inverting $4 F_1(r, s) F_2(r, s)$ by (1), we can compute the frequency function of the distribution of $(\xi_1, \xi_2, \eta_1, \eta_2)$. Similarly the frequency function of $(1/\xi_1, 1/\eta_1)$ has Mellin transform $4 F_1(2 - r, 2 - s)$ and of $(\xi_1/\xi_2, \eta_1/\eta_2)$ has Mellin transform $4 F_1(r, s) F_2(2 - r, 2 - s)$ and so the frequency functions of these distributions can be computed by (1). Results of this nature can be obtained for various products and ratios of the random variables (ξ_1, η_1) and (ξ_2, η_2). The case of unsymmetrical frequency functions is also considered.

15. A Classification of Kernels Which Possess Integral Transforms. By Charles Fox. Presented by W. L. G. Williams, F.R.S.C.

If
$$K(s) = \int_0^{\infty} k(x)\, x^{s-1} dx, K(s)$$

is the Mellin transform of $k(x)$. It is well known that if $K(s)K(1 - s) = 1$ then $k(x)$ can be the kernel of a Generalized Fourier transform. In this paper I consider kernels for which $K(s)K(1 - s) \neq 1$. If $K(s) = H(s)/(m + ns)$ where $H(s)H(1 - s) = 1$, m,n are constants, I prove that

$$(1) \qquad f(x) = \int_0^{\infty} k(ux)\, g(u)\, du$$

$$(2)\quad g(x) = a\int_0^\infty k(ux)\,f(u)\,du + b\,\frac{d}{dx}\int_0^\infty x\,k(ux)\frac{d}{du}\{u\,f(u)\}\,du,$$
$$a = m^2 + mn,\ b = n^2.$$

An example of such a kernel is

$$k(x) = x\int_x^\infty \frac{\cos u}{u^2}\,du.$$

I then show that kernels with Mellin transforms given by $K(s) = H(s)/(m + ns)P\{s(1-s)\}$ and $K(s) = H(s)/P\{s(1-s)\}$, $H(s)H(1-s) = 1$ and P denotes a polynomial form, also have transforms analogous to (1), (2) but more complicated. In the second case the transforms are symmetrical and a Parseval theorem exists of the form

$$\int_0^\infty f(x)^2dx = \int_0^\infty g(x)^2ds.$$

It is then possible to form a classification in which the type of transform for which $k(x)$ is a kernel is related to the properties of its Mellin transform $K(s)$. Thus Fourier kernels form class 1, kernels for (1), (2) form class 2, etc. We can frequently go from one class to the next by convolution.

16. A Generalized Scalar Product. By István Fáry. Presented by W. L. G. Williams, F.R.S.C.

Let R^n be an n-dimensional vector space over the reals R. The set of rays $\bar{x} = \{y: y\epsilon R^2, y = \lambda x, \lambda \geqslant 0\}$ $(x \neq 0)$ in an R^2 is a space S homeomorphic to a circle. A generalized angle in R^2 is by definition a non-degenerated additive interval function on S. A continuous function f: $R^n \times R^n \to R$ will be called *generalized scalar product*, if: (1) $f(x, y) \geqslant 0$, and $f(x, x) = 0$ implies $x = 0$, (2) $f(x, y) = f(y, x)$, (3) $f(\lambda x, y) = |\lambda| f(x, y)$, (4) $f(x + y, z) \leqslant f(x, z) + f(y, z)$, where $x, y, s\epsilon R^n$, $\lambda\epsilon R$. Set

$$n(x) = \sqrt{f(x, x)},\quad cm(x, y) = f(x, y)/n(x)\,n(y)(x \neq 0,\quad y \neq 0),$$
$$sm(x, y) = \sqrt{1 - (cm(x, y))^2}.$$

Then n is a Minkowskian norm in R^n, and sm determines a generalized angle θ in every $R^2 \subset R^n$. (sm is an interval function on S and θ is its Burkill integral.) We shall call n the norm and θ the generalized angle induced by f. Main result: Given a Minkowskian norm n and a generalized angle θ (both satisfying mild differentiability conditions), there is a generalized scalar product f inducing n and θ.

17. Derivations of the Group Algebras of a Class of p-groups. By S. A. Jennings and Rimhak Ree. Presented by R. D. James, F.R.S.C.

Let G be a p-group of class 2 with $A^p = 1$ for all $A \in G$, let Z be the center and C be the derived group of G. If $\Gamma = \Gamma(G)$ is the group algebra of G over a field Φ characteristic p, we may consider the Lie Algebra L of all derivations of Γ over Φ. We prove that L contains a solvable ideal S such that $L/S \cong J$, where J is the simple Lie Algebra of derivations of $\Gamma(Z/C)$. In particular, if $Z = C$, then L is solvable.

18. Maximal Properties of Symmetric Functions of Singular Values. By M. Marcus and B. N. Moyls. Presented by R. D. James, F.R.S.C.

Let Q_{kr} denote the set of all sequences ω of integers $i_1, i_2, \ldots, i_r$, satisfying $1 \leqslant i_1 < i_2 < \ldots < i_r \leqslant k$. For vectors x and y in complex n-space V_n, let $x \wedge y$ denote the Grassmann product. For vectors $x_1, \ldots, x_k$ in V_n and $\omega \epsilon Q_{kr}$, set

$$x_\omega = x_{i_1} \wedge x_{i_2} \wedge \ldots \wedge x_{i_r}.$$

Let $A_1, \ldots, A_m$ be a set of linear transformations of V_n, and let $\lambda_{\sigma i} \geqslant \lambda_{\sigma, i+1}$, $i = 1, \ldots, n-1$ be the eigenvalues of $A_\sigma^* A_\sigma$. Let $C_r(A)$ denote the rth compound operator of A, and $E_r(a_1, \ldots, a_k)$ the rth elementary symmetric function of the numbers $a_1, \ldots, a_k$. *If $x_1, \ldots, x_k$ are orthonormal, $U_1, \ldots, U_m$ are unitary, and $s \geqslant 1$, then, for $1 \leqslant r \leqslant k \leqslant n$,*

$$\left| \sum_{\omega \epsilon Q_{kr}} (C_r(U_1 A_1 \ldots U_m A_m)\, x_\omega, x_\omega)^{2s} \right| \leqslant \prod_{\sigma=1}^{m-1} \prod_{i=1}^{r} \lambda_{\sigma i}^{s} E_r(\lambda_{m1}^{s}, \lambda_{m2}^{s}, \ldots, \lambda_{mk}^{s}).$$

For $m = 1$, the latter expression becomes $E_r(\lambda_{11}^{s}, \ldots, \lambda_{1k}^{s})$, and is taken on for an appropriate choice of U_1 and $x_1, \ldots, x_k$. This result extends a recent maximum property given by Fan (Proc. N.A.S. (U.S.A.) *37*(1951), 760–766).

19. Sous-algèbres de Cartan et décompositions de Levi dans les algèbres de Lie. By J. Dixmier. Presented by I. Halperin, F.R.S.C.

Soient $\mathfrak{a}$ une algèbre de Lie sur un corps K de caractéristique O, $\mathfrak{h}$ une sous-algèbre de Cartan de $\mathfrak{a}$, $\mathfrak{s}$, une sous-algèbre semi-simple de $\mathfrak{a}$ telle que $\mathfrak{a} = \mathfrak{r} + \mathfrak{s}$ et telle que $\mathfrak{h} = (\mathfrak{h} \cap \mathfrak{r}) + (\mathfrak{h} \cap \mathfrak{s})$. L'existence de $\mathfrak{s}$ a été prouvée par Chevalley. On prouve que $\mathfrak{h} \cap \mathfrak{s}$ ne dépend que de $\mathfrak{h}$ et non de $\mathfrak{s}$. Supposons K algébriquement clos. Pour toute racine α de $\mathfrak{a}$ relativement à $\mathfrak{h}$, soit $\mathfrak{a}^\alpha$ le sous-espace de $\mathfrak{a}$ formé des $x \epsilon \mathfrak{a}$ qui, pour tout $h \epsilon \mathfrak{h}$, sont annulés par une puissance assez grande de $\mathrm{adh} - \alpha(h)$. Alors, $\mathfrak{s}$ peut être choisie de manière que tout $\mathfrak{a}^\alpha$ soit somme directe de ses intersections avec $\mathfrak{s}$ et $\mathfrak{r}$.

Wednesday, 9.00 a.m. Papers 20–25.

20. On the Fourier Coefficients of Essentially Bounded Functions. By W. A. J. Luxemburg. Presented by Israel Halperin, F.R.S.C.

Let

$$\tfrac{1}{2} a_0 + \sum_{n=1}^{\infty} (a_n \cos nx + b_n \sin nx) \tag{1}$$

be an arbitrary trigonometric series. In 1931, R. Salem gave necessary and sufficient conditions which must be satisfied by the coefficients (a_n, b_n) of (1) in order that (1) be the Fourier series of a 2π—periodic—Lebesque integrable function. In this note we give necessary and sufficient conditions which the coefficients of the series (1) must satisfy in order that (1) be the Fourier series of a 2π—periodic essentially bounded function. Other generalizations are given.

21. Matrix-like Representations of Group Algebras. By Harry F. Davis. Presented by R. D. James, F.R.S.C.

In this paper we explore the problem of representing a Banach algebra by multiple sheeted matrices, each "sheet" being the topological product of two replicas of the maximal ideal space of an abelian subalgebra. The purpose of this research is to obtain new information about the algebra of Haar summable functions on groups which are neither compact nor abelian. Some unpublished results of Ambrose are generalized and used to obtain a direct integral decomposition of L_2 systems into simple H systems.

22. The *Problème de Ménages*. By L. Moser and Max Wyman, F.R.S.C.

The classical *problème de ménages* has been solved by Touchard, Schöbe, Kaplansky and others. In this paper the problem is attacked in still another way and for the *ménage* numbers a generating function and several new explicit formulae are obtained. From one of these representations it follows that the known asymptotic formula

$$u_n \sim n!\, e^{-2}\left[1 - \frac{1}{n-1} + \frac{1}{2!(n-1)_2} - \ldots + \frac{(-1)^t}{i!(n-i)_t} + \ldots\right]$$

can actually be used to compute u_n exactly. At the authors' request, F. L. Miksa has computed u_n exactly for $3 \leqslant n \leqslant 63$ thus extending the tables of E. Lucas.

23. Restricted Partitions of Finite Sets. By L. Moser and M. Wyman, F.R.S.C.

Let the polynomials $G_{n,r}(t)$ be defined by

$$\sum_{n=0}^{\infty} G_{n,r}(t)\, x^n/n! = e^{t(x+x^2/2!+\ldots+x^n/r!)}.$$

H. Hadwiger has shown that if

$$G_{n,r}(t) = \sum_{s=1}^{n} \sigma_{n,r} t^s$$

then $\sigma_{n,r}$ enumerates the number of ways in which n distinguishable objects can be placed in s indistinguishable boxes so that no box is empty or contains more than s objects. In this paper an explicit expression for $\sigma_{n,r}$ is obtained. The numbers $G_{n,r}(1) = G_{n,r}$ enumerate the number of ways in which the n objects can be placed in any number of boxes with no box containing more than r objects. For $G_{n,r}$ various recursions are obtained, arithmetic properties found, and an asymptotic formula valid for fixed r and $n \to \infty$ is derived. The latter is checked by means of tables of $G_{n,r}$ for the range $r \leqslant n < 20$ computed at the authors' request by F. L. Miksa.

24. On some Properties of Certain Fractional Integrals. By P. G. Rooney. Presented by G. de B. Robinson, F.R.S.C.

The author's results in Trans. Roy. Soc. Can. XLIX (1955), are generalized to various types of fractional integrals due to Kober and Erdélyi. Applications to the study of certain integral transforms are made.

25. On the Lie Theory of Continuous One-Parameter Projective Groups in the Complex Plane. By S. Beatty, F.R.S.C.

The infinitesimal, projective transformations

$$dZ = (A + BZ + CZ^2)dt, \ (A, B, C \text{ complex}, t \text{ real}), \text{ are } \infty^5 \text{ -fold,}$$

corresponding to the ∞^5 -fold ratios of the real and imaginary parts of A, B, C, and each of them, under integration from the combination z, o to the combination Z, t, generates a continuous one-parameter group of projective transformations

$$Z = \frac{az + b}{cz + d} \ (a, b, c, d \text{ functions of } t),$$

and their totality the general ∞^6 -fold group of projective transformations

$$Z = \frac{az + b}{cz + d} \ (a, b, c, d \text{ complex}, ad - bc = 1).$$

These continuous one-parameter groups are here studied by considering in each case their families of isometric circles and directed lines through their centres, resulting from $|dZ/dz| = 1$ and $dZ/dz > 0$ respectively.

CHEMISTRY

Tuesday, 9.00 a.m. Papers 26–36.

26. Radiation Decomposition of Aqueous Bromal Hydrate Solutions. By R. J. Wood and J. W. T. Spinks, F.R.S.C.

When aqueous solutions of bromal hydrate are irradiated with Co^{60} gamma rays, acid is produced. For a given dose rate, the amount of acid produced is proportional to the dose. The yield is a function of the bromal concentration and of the dose rate. The reaction is a chain reaction.

27. Addition of Butyl Mercaptan to Pentene on Irradiation with Gamma Rays. By A. Fontijn and J. W. T. Spinks, F.R.S.C.

N-butyl mercaptan reacts with pentene-1 when irradiated with gamma rays. The rate of reaction depends on the concentrations of mercaptan and pentene, but is independent of the dose rate. A comparison with the photo-initiated reaction is made.

28. The Mercury Photosensitized Decomposition of C_2–C_4 Olefins. By F. P. Lossing, D. G. H. Marsden, and J. B. Farmer. Presented by E. W. R. Steacie.

The mercury photosensitized (Hg^3P_1) decomposition of olefins has been examined using a reactor coupled directly to a mass spectrometer. The primary split of ethylene has been shown to be predominantly molecular, and that of propylene mainly into an allyl radical and a hydrogen atom. With 1-butene the split is predominantly at a C–C bond giving allyl and methyl radicals, although a rupture of a C–H bond occurs as well. With 2-butene and isobutene a C–H bond is broken. It is concluded that the allyl and methallyl radicals produced have large cross-sections for reaction with excited mercury atoms.

29. Thermal Decomposition of 1-Hexanethiol. By Paul E. Gagnon, F.R.S.C., Jean L. Boivin, and Donald C. Watson.

Investigation has been conducted on the thermal decomposition of 1-hexanethiol. Quantitative estimation of the pyrolysis products, both liquid and gaseous, has necessitated the development of improved methods for the analysis of unsaturated hydrocarbons and dialkyldisulphides in the presence of thiols and other sulphur containing compounds. Desulphurization characteristics of metal sulphide catalysts and supports, and the effect of temperature and flow rates, have also been considered.

30. A Contribution to the Study of Phenazines. By Paul E. Gagnon, F.R.S.C., Karl F. Keirstead, and Brian T. Newbold.

A series of chloro-compounds all containing the phenazine ring has been prepared and their structures have been determined.

31. Hydrolysis and Hydrazinolysis of Esters of N,N-Dimethyldithiocarbamic Acid. By Marshall Kulka, F.R.S.C.

A method has been developed for the preparation of mercaptans (IV) from alkyl and aralkyl chlorides (I). This consists of the condensation of sodium N,N-dimethyldithiocarbamate (II) with halides (I) followed by alkaline hydrolysis or hydrazinolysis of the resulting N,N-dimethyldithiocarbamates (III). In the hydrazinolysis of III, an insoluble solid by-product

$$\underset{\text{I}}{RCl} + \underset{\text{II}}{NaS_2CN(CH_3)_2} \rightarrow \underset{\text{III}}{RS_2CN(CH_3)_2} \rightarrow \underset{\text{IV}}{RSH}$$

was formed which was identified as 3-hydrazino-4-amino-5-mercapto-4,2,1-triazole.

Although this method was found to have wide scope a few failures were encountered. Nitro-derivatives of III were sensitive to alkali or hydrazine and yielded only tars on attempted degradation to IV. β-Phenoxyethyl N,N-dimethyl-dithiocarbamates (V) were found to possess a labile alkyl-oxygen bond so that in the presence of alkali or hydrazine only the corresponding phenols were formed. The labile nature of the alkyl-oxygen bond ceased abruptly when the alkyl chain of V was increased so that 3-p-chlorophenoxypropyl and 4-p-chlorophenoxybutyl mercaptans could be prepared in high yields.

32. Inhibition sélective de l'oxydation de l'éther par l'oxyde nitrique. Par A. Lemay et C. Ouellet, M.S.R.C.

L'injection de petites quantités d'oxyde nitrique au cours de l'oxydation lente de l'éther en phase gazeuse permet d'arrêter au moment choisi la consommation de l'oxygène, sans altérer la vitesse des réactions secondaires responsables de l'augmentation de pression. Cette méthode, applicable à d'autres oxydations, permet d'arrêter à un point donné la formation des produits primaires d'une oxydation et de suivre leurs transformations subséquentes.

33. A Study of the Enzymes which Hydrolyze Sarin and Tabun. By P. A. Adie. Presented by G. O. Langstroth, F.R.S.C.

A thorough knowledge of the biochemistry of organophosphorus cholinesterase inhibitors requires a study of the enzymes which hydrolyze the inhibitors. It has been shown that the

rate of hydrolysis of the inhibitor affects the toxicity. The reaction kinetics of the cholinesterase inhibition and the hydrolysis of the inhibitor are discussed.

The enzymic hydrolysis rates of sarin and tabun are compared for different tissue preparations. The Michaelis Menton constants, the activation energies and enzyme stabilities have been studied. In the light of the results obtained enzyme specificity is discussed. The sarinase of bovine plasma has been purified.

34. Organic Deuterium Compounds. XVII, The Addition of Deuterium Chloride and Bromide to Chloroölefins: Synthesis of Deuterated Methylchloroform. By J. E. Francis and L. C. Leitch. Presented by Dr. Léo Marion, F.R.S.C.

Deuterated methylchloroform was synthesized from trichloroethylene by the following reactions:

$$CHCl{=}CCl_2 \underset{D_2O}{\overset{OD}{\rightleftharpoons}} CDCl{=}CCl_2 \xrightarrow[AlCl_3]{DCl} CD_2ClCCl_3$$

$$CD_2ClCCl_3 \xrightarrow[EtOH]{Zn} CD_2{=}CCl_2$$

$$CD_2CCl_2 \xrightarrow[AlCl_3]{DCl} CD_3CCl_3.$$

The semideuterated molecules $CHDClCCl_3$ and $CHD{=}CCl_2$ could not be prepared by this route on account of exchange between deuterium chloride and the chloroölefins.

The addition of deuterium bromide to 1,1-dichloroethylene and vinyl chloride was also investigated. The products were 1-bromo-2,2-dichloroethane-2-d and 1-bromo-2-chloroethane-d respectively.

35. Condensation of Aliphatic-Thiocyanocarboxylic Acid Esters with Hydrazine and Phenylhydrazine. By Paul E. Gagnon, F.R.S.C., Jean L. Boivin, and G. Manley Brown.

A series of thiocyanoesters, $RCH(SCN)COOR'$ ($R{=}H$ or C_nH_{2n+1}, $n{=}1-8$; $R'{=}CH_3$ or C_2H_5) was prepared from the corresponding bromoesters in yields of 65–75 per cent. These high-boiling liquids were condensed with hydrazine and phenylhydrazine to give crystalline 5-alkyl-2,4-thiazolidione-2-azines and 5-alkyl-2-imino-3-phenylamino-4-thiazolidones, respectively, in yields of 20–50 per cent.

36. Condensation of 1-phenyl-3-amino-5-pyrazolone with Alkyl and Aryl Aldehydes. By Paul E. Gagnon, F.R.S.C., Paul A. Boivin, Jean L. Boivin and John H. Dickson.

When 1-phenyl-3-amino-5-pyrazolone was condensed with several alkyl and aryl aldehydes the corresponding 4-substituted pyrazolones were obtained.

$R{=}CH_3CH$; $CH_3(CH_2)_2CH$; $CH_3(CH_2)_3CH$; C_6H_5CH; $C_6H_5CH_2CH$.

The aryl and higher alkyl aldehydes formed crystalline products, the former in almost quantitative fields. The lower alkyl aldehydes produced oils.

Wednesday, 9.00 a.m. Papers 37–44.

37. New Methods of Dimensional Stabilization of Wood. II, Phthaloylation of Wood. By D. F. Arseneau and J. Risi, F.R.S.C.

The fixation of the hydrophilic hydroxyl groups in ligno-cellulose by etherification or esterification increases the dimensional stability of wood against moisture. After some work on vapor-phase acetylation (Communication I), the authors studied liquid-phase phthaloylation using both dimethylphthalate and dimethylformamide as solvent. For the first time in wood chemistry antishrink efficiencies close to 100 per cent are reported and other properties of phthaloylated wood are discussed.

38. The Effect of a Methoxyl Substituent on the Direction and Rate of Anionotropic Rearrangement in the 1,5-Diphenylpentadienol System. By L. W. Trevoy and E. A. Braude. Presented by J. W. T. Spinks, F.R.S.C.

The following alcohols have been prepared: 1,5-diphenyl-1,4-pentadien-3-ol (I), 1-(*p*-methoxyphenyl)-5-phenyl-1,4-pentadien-3-ol (II), 1-(*p*-methoxyphenyl)-5-phenyl-2,4-pentadien-1-ol (III), 1-phenyl-5-(*p*-methoxyphenyl)-2,4-pentadien-1-ol (IV) and 1-(*p*-cyanophenyl)-5-phenyl-1,4-pentadien-3-ol (V).

The kinetics of the acid catalyzed rearrangements of I and II in 60 per cent aqueous dioxane were studied at five temperatures by measuring changes in the ultraviolet absorption of the reaction solution. By comparison with the ultraviolet absorption curves of III and IV, the identity of the rearrangement product was established. Attempts to rearrange V were unsuccessful.

39. The Extraction of Ionium (Th^{230}) from a Canadian Pitchblende Residue and the Separation of Protactinium and Uranium from Neutron Irradiated Ionium. By A. P. Baerg and A. B. Van Cleave. Presented by J. W. T. Spinks, F.R.S.C.

A method for the extraction of ionium (Th^{230}) from a "rare earth fraction," accumulated in the radium purification process of Canadian pitchblende, has been developed. The efficiency of the process is about 90 per cent. The ratio of Th^{232}/Th^{230} in the concentrate was 2.63.

The separation of thorium, protactinium and uranium in the neutron irradiated sample of ionium concentrate was accomplished on an anion exchange resin by elution of the thorium with 8M HCl followed by elution of the protactinium with 4N HCl and finally of the uranium with 4N HNO_3.

40. The Ultraviolet Absorption Spectra of Polynuclear Aromatic Hydrocarbons. I, Methyl-1,2-benzanthracenes. By C. Sandorfy and R. N. Jones, F.R.S.C.

Considerable attention has been given in recent years to the quantum mechanical computation of the energy levels in polynuclear aromatic hydrocarbons, and to the calculation of the perturbations of these energy levels which result from methyl substitution.

We have examined the ultraviolet absorption spectra of 1,2-benzanthracene, all twelve monomethyl-1,2-benzanthracenes, and six dimethyl-1,2-benzanthracenes at −100°C in n-pentane solution.

These spectra exhibit series of evenly spaced bands, the intensities and positions of which are sensitive to the position of methyl substitution. The spectra are difficult to reconcile with the conclusions of the quantum mechanical treatment in its present state of approximation and electronic states additional to those predicted by current theory may also be involved.

41. The Ultraviolet Absorption Spectra of Polynuclear Aromatic Hydrocarbons. II, Methyl-3,4-benzphenanthrenes. By E. Spinner and R. N. Jones, F.R.S.C.

The ultraviolet absorption spectrum of 3,4-benzphenanthrene and all five monomethyl derivatives have been measured at −100° C in n-pentane solution.

These compounds are isomeric with the methyl-1,2-benzanthracenes discussed in the preceding paper. The spectra appear less sensitive to temperature and to the position of methyl substitution than do the spectra of the 1,2-benzanthracenes and in general they conform more closely with the predictions of current theory.

42. Diffusion of the Chloride Ion in NaCl and in KCl. By D. Patterson and J. A. Morrison, F.R.S.C.

The activation energies and diffusion coefficients for the self-diffusion of the chloride ion in NaCl and in KCl have been determined using a new tracer technique. The method depends upon a rapid isotopic exchange which has been found to occur between surfaces of alkali chlorides and chlorine gas. Owing to this rapid exchange, the rate at which Cl^{36} incorporated in the alkali chloride appears in the surrounding chlorine gas is fixed by its rate of diffusion through the solid lattice to the surface. The results will be compared with existing data for the diffusion of the positive ions.

43. Reactions of Oxygen Atoms with Olefins. By R. J. Cvetanović. Presented by I. E. Puddington, F.R.S.C.

Reactions of oxygen atoms, produced by photosensitized decomposition of nitrous oxide, with a number of unsaturated hydrocarbons have been studied under a variety of conditions. Use has been made of gas-liquid partition chromatography for qualitative and quantitative determination and for isolation for analysis by other methods of some of the reaction products. Addition of oxygen atoms to the double bond of olefinic hydrocarbons takes place very readily and the reaction rate is considerably greater for larger molecules, such as butenes, than for ethylene. With butenes the initially formed addition products do not undergo any appreciable decomposition, although extensive isomerization takes place.

44. Polymerization of Methacrylonitrile at Elevated Temperatures. By S. Bywater. Presented by I. E. Puddington, F.R.S.C.

The photosensitized polymerization of methacrylonitrile has been studied at temperatures above 100° C. Evidence of a simultaneous depolymerization reaction has been obtained under these conditions. Use of this type of data in calculations of the heat and entropy of polymerization is discussed.

SOLID STATE AND SPECTROSCOPY

Tuesday, 2.00 p.m. Papers 45–53, 105, 106.

45. Theoretical Aspects of Electron-Photon Interactions in Semiconductors. By R. E. Burgess. Presented by G. M. Volkoff, F.R.S.C.

For semiconductors with an energy gap less than about 0.35eV (for example Te, PbS, InSb) the main process of electron-hole recombination in good crystals is due to direct transitions between the bands with photon emission. Reversible electron-photon reactions are examined for the steady-state condition and the fluctuations about a steady-state are determined. The special case of black-body radiation leads to results which are interpreted statistically and thermodynamically and which indicate fundamental limitations in the sensitivity of photoconductive detectors. When the temperatures of the radiation and the crystal are different, considerations of the rate of increase of entropy are applicable to the irreversible processes which occur.

46. The Magnetic Susceptibility of the Magnesium-Cadmium System. By L. D. Calvert, R. Datars, M. Garber and W. G. Henry. Presented by I. E. Puddington, F.R.S.C.

The concentration dependence of the magnetic susceptibility of the disordered phase has been measured at room temperature on quenched specimens by a modified Gouy method. At approximately 58 at. per cent cadmium where there is an abrupt change in the c/a ratio, a sharp break in the susceptibility curve is found. In the region 0–10 at. per cent cadmium there is another anomaly in the susceptibility curve. New lattice parameter measurements made at 310° C show an associated irregularity. The results are discussed in connection with the Brillouin zone structure of magnesium.

47. The Polymorphs of Calcium. By Helen S. Dunsmore, L. D. Calvert, and W. A. Alexander. Presented by I. E. Puddington, F.R.S.C.

The polymorphic forms of calcium have been investigated by high temperature X-ray methods. Evidence showing the existence of four phases has been obtained and these can be compared with recently discovered forms of strontium.

48. The Reflection Coefficient in the Ultraviolet and Near Infrared of the α Solid Solutions of Zinc, Gallium, Germanium, and Arsenic in Copper. By W. G. Henry. Presented by I. E. Puddington, F.R.S.C.

The frequency dependence of the reflection coefficient has been measured, as a function of composition, for the four systems at room temperature from 2200 Å to 10,000 Å using a reflectance attachment for a Beckman DU spectrophotometer. The displacement of the absorption edge at 5750 Å and the dependence of the reflection coefficient on electron concentration are discussed.

49. Some General Considerations concerning the Theory of Order-Disorder Transitions. By H. Grayson-Smith, F.R.S.C.

Except in a few simple cases there are large discrepancies between the theoretical and experimental specific heat anomalies associated with so-called "second-order transitions."

In this paper the theory of such transitions is examined on the basis of general assumptions which would apply to several different molecular mechanisms. It is shown that the discrepant theoretical result always arises if the internal energy of a partially disordered configuration is taken to be a linear sum over pairs of molecules. However, a very small term proportional to the number of molecules involved can remove the discrepancy.

50. The Excitation of Spectra in Gases by Ion Beams. By D. Pleiter and R. W. Nicholls. Presented by A. D. Misener, F.R.S.C.

The excitation of part of the auroral spectrum by impact of protons from the sun upon the upper atmosphere of the earth is incompletely understood.

In order to study similar excitation in the laboratory, a Kunsman type thermionic source of lithium ions has been designed and built. Spectra excited in O_2, N_2, air, and A, by the ribbonlike ion beam, up to energies of 4kV, have been examined and interpreted in terms of charge exchange and dissociation, which seem to be the most reasonable dominant mechanisms.

This work has been performed with the assistance of contract No. AF 19(122)–470 with the Air Force Cambridge Research Centre.

51. The Chromospheric Spectrum of 31 Cygni. By K. O. Wright, F.R.S.C.

At the 1951 eclipse of the important system, 31 Cygni, a series of high-dispersion grating spectrograms in the region λλ3700–4500 was obtained during ingress. Sharp, chromospheric absorption lines of Fe I could be detected at least twelve days before totality and the intensities of these lines have been analysed. Turbulent velocities derived from curves of growth range from 8 to 15 km/sec and may increase somewhat with height in the atmosphere. Excitation temperatures increase with height from 2500° K at -2^d to 4500° K at -10^d. The number of neutral iron atoms observed in the column traversed by the light of the small secondary star decreases by a factor of 3000 in the same time. The analysis has been made by measuring total absorptions on intensity tracings and relating them to the apparent continuum of the B-type star at each wave-length. The light ratio of the two stellar continua was obtained from a comparison of intensities in the composite spectrum taken well out of eclipse with those in the totally eclipsed spectrum. Occultation effects could be detected at least two days before totality.

52. The Multiplet and Hyperfine Structure of Indium Spark Spectra. By R. A. Nodwell and A. M. Crooker. Presented by G. M. Shrum, F.R.S.C.

The spark spectra of indium have been photographed and measured in the region λλ2608200Å on grating and prism spectrographs. An electrodeless discharge and a condensed vacuum spark source permitted the selective excitation of the spark lines belonging to In II, III, IV, V. In In III we have added the terms $4d^9\,5s^2\,{}^2D$, $6_d\,{}^2G$, $7_g\,{}^2G$, $8_s\,{}^2S$ and resolved $4f\,{}^2F$. The extended series allow a reliable value of the ionisation potential to be estimated as 226, 180 cm^{-1}. We have confirmed the h.f.s. intervals of Campbell and Davis (Phys. Rev., *55* (1939), 1125L) and added those of 6_s, 7_s and $6_p\,{}^2P_{\frac{1}{2}}$, respectively 0.97 cm^{-1}, 0.37 cm^{-1} and 0.19 cm^{-1}. Our multiplet analyses of In IV and V are presently in agreement with the previous analyses due to White (Phys. Rev., *31* (1928), 776) and Green (Phys. Rev., *60* (1941), 117), which we expect to extend.

53. Nuclear Quadrupole Resonance of B^{11} in Kernite. By R. R. Haering and G. M. Volkoff, F.R.S.C.

Pure quadrupole resonances of B^{11} nuclei at two different sites in a single crystal of $Na_2B_4O_7.4H_2O$ (kernite) have been found experimentally at 1281.1 ± 2 and 1287.0 ± 1 kc/sec. Their Zeeman splitting has been studied in weak magnetic fields up to 30 gauss. These results are compared with the theoretically expected ones calculated from the observed high-field (7000 gauss) spectrum of B^{11} in kernite. Good agreement between the weak and strong field results has been obtained for one, but not for the other site.

METEOROLOGY

Wednesday, 9.00 a.m. Papers 54–60.

54. An Inherent Precipitation Mechanism in Cumulus Clouds. By T. W. R. East. Presented by J. S. Marshall, F.R.S.C.

In the growth of cloud droplets in cumulus from condensation nuclei to raindrops, condensation slows down at 18 microns radius and coalescence becomes vigorous at 50 microns. Since neither process alone can bridge the gap, others have proposed giant salt nucleus or ice crystal mechanisms.

A combined condensation-coalescence mechanism, inherent in all cumulus, is shown to be sufficient; further, it accounts for the height of first appearance, and subsequent behaviour, of the radar echo. A necessary condition for precipitation by this means is the condensing of sufficient liquid water, 4 to 7 g per kg of air being required.

55. Snow Echo Pattern on a Constant Altitude Surface. By M. P. Langleben. Presented by J. S. Marshall, F.R.S.C.

The snow-generating cells associated with most snowstorms have been observed in previous radar studies only in vertical section. Constant-altitude upper-level maps reveal the plan-pattern formed by these cells at the generating level.

Individual cells are rather shapeless, but with all dimensions within a factor two of 1 mile, and persist for hours. Their velocity equals the generating level wind. The cells occur in groups of several hundred, either randomly distributed over an area of about 10,000 square miles or in line arrays each about 5×75 miles over the same area.

56. A Preliminary Study of the High-Latitude Stratospheric Jet Stream in Winter. By R. Lee and W. L. Godson. Presented by Andrew Thomson, F.R.S.C.

During October, temperature gradients at the 100-mb level (near 50,000 ft.) in the Canadian Arctic (64°–83° N) are very small. The onset of polar darkness at high levels produces a N–S temperature gradient and an associated quazi-zonal jet stream. These zones move slowly southward during November, and are still in evidence at the end of February. Hitherto the existence of this high-latitude high-altitude jet stream had been revealed only on a statistical basis; the present study presents synoptic evidence based on atmospheric cross-sections.

57. Numerical Forecasting with a One-Level Atmospheric Model. By T. J. G. Henry and W. L. Godson. Presented by Andrew Thomson, F.R.S.C.

The assumption that the wind at each level is in approximate geostrophic balance with the pressure distribution, and is proportional in speed and parallel in direction to the wind at a standard level, leads to a Poisson equation for the local time derivative of the height of a representative isobaric surface. Changes in the topography of this surface, and hence in the wind field, can be forecast for 24 to 48 hours ahead by integrating this equation in time for a grid of points. Experimental forecasts with this model are being made on the University of Toronto's electronic computer.

58. The Turbulent Diffusion of Particulates from an Elevated Source. By W. L. Godson. Presented by Andrew Thomson, F.R.S.C.

Following Sutton's theory of atmospheric turbulence, surface concentrations and rates of deposition of aerosols have been calculated for a number of cases. From these computations it is possible to demonstrate the relative effects, on both surface concentrations and deposition rates for elevated point and line sources, of wind speed, particle size, stack height, and atmospheric stability. Particular attention will be paid to the location and magnitude of down-wind maxima of pollutant concentrations at the ground. The results are readily applicable to problems of control of atmospheric pollution, and may be used to estimate, indirectly, the diffusion of gaseous aerosols.

59. Anisotropic High-Level Turbulence. By J. Clodman and W. L. Godson. Presented by Andrew Thomson, F.R.S.C.

A study has been made of a number of cases of turbulence encountered by aircraft in high-level flight in which the intensity of turbulence varied with the direction of aircraft heading. The direction of maximum turbulence was found to coincide quite closely with that of the wind streamlines. It does not appear that gravity waves can offer a reasonable explanation. A satisfactory dynamic theory is developed in which this anisotropic turbulence is attributed to quasi-horizontal gusts associated with strong horizontal wind shear.

60. Air Masses Involved in Snow-Generation. By R. H. Douglas. Presented by Andrew Thomson, F.R.S.C.

The previously determined relationship between snow-generating level and frontal height is confirmed, with cellular snow-generation occurring chiefly within the lowest portion of the maritime Polar air mass. The last third of a snowstorm is usually characterized by homogeneous unpatterned snow originating below the maritime front in the maritime Arctic air mass. The snow-producing mechanism during this latter phase is essentially non-convective, in contrast to the cellular process associated with the earlier part of the storm.

NUCLEAR PHYSICS

Tuesday, 9.00 a.m. Papers 61–69.

61. A Time-to-Amplitude Converter for Very Fast Coincidence Studies. By R. E. Green and R. E. Bell, F.R.S.C.

The McGill multichannel kicksorter is being used as a time delay analyser with the resolution of a fast delayed coincidence circuit but with much increased counting efficiency. Shaped and limited pulses from two scintillation counters are applied to the two control grids of a 6BN6 tube operated at low electrode voltages. Anode current flows in the 6BN6 only when the input pulses overlap; the integrated anode pulses therefore vary linearly with delay between the two input pulses. The time spectrum for Co^{60} γ–γ coincidences forms a peak $<10^{-9}$ sec. wide with sides dropping off with an instrumental half life $<2 \times 10^{-10}$ sec.

62. Normal Modes of Aluminum by Neutron Spectrometry. By B. N. Brockhouse and A. T. Stewart. Presented by D. G. Hurst, F.R.S.C.

The inelastic scattering of neutrons from a crystalline solid may be described as the interaction of a neutron with one of the vibrational modes of the crystal. The energy exchanged between the vibrational mode and the neutron is one unit (a phonon) of the characteristic energy of that particular mode. In two experiments, one using the instrument described above and one using a crystal spectrometer (B. N. Brockhouse and A. T. Stewart Phys. Rev. *100* (1955), 757), the changes in the energy of neutrons scattered by a single crystal of aluminum in various orientations have been measured. From the measurements the relation between the energy and momentum of the phonons is obtained and experimentally demonstrates the dispersion of the velocity of propagation of the vibrational modes (velocity of sound waves) of the crystal.

63. Method of Measuring Energy Changes in the Scattering of Slow Neutrons and Some Results. By A. T. Stewart and B. N. Brockhouse. Presented by D. G. Hurst, F.R.S.C.

Slow neutrons may undergo energy changes on scattering which yield information about the energy level structure of the scatterer. To observe these energy changes monoenergetic neutrons are scattered by a specimen and the energy of the scattered neutrons measured by a time of flight technique using a mechanical chopper. The chopper rotates at 7200 r.p.m. and passes slow neutrons for about 6° per half revolution through an aperture about 9 cm × 17 cm. The flight path is about 4.6 m. The initially monoenergetic neutrons (0.003–0.005 ev.) are obtained by difference filter technique which uses those neutrons with wavelengths between the Bragg cut-offs of Be and Pb.

64. Bremsstrahlung Spectra. By W. R. Conkie and R. Skinner. Presented by L. Katz, F.R.S.C.

We have made corrections to the bremsstrahlung spectrum calculated by Schiff (L. I. Schiff, Phys. Rev. *83* (1951), 252). These corrections are important in the analysis of yield curves for (γ, x) reactions induced by radiation from a Betatron. The corrections arise from two sources: (1) The calculation of the Schiff spectrum fails at the high photon energy tip due to the use of the Born approximation. This is corrected by using Sommerfeld-Maue

wave functions (A. Sommerfeld and A. W. Maue, Ann. der Physik, *22* (1935), 629) in a fashion similar to that employed by Bethe and Maximon in their high energy treatment of the bremsstrahlung process (H. Bethe and L. Maximon, Phys. Rev. *93* (1953), 768). We have essentially calculated the first term in a Taylor series expansion in powers of the scattered electron momentum, so that the values we obtain are accurate only at the high photon energy tip, where the scattered electron has small, or zero momentum. Our spectral values for small scattered electron momentum have then been joined graphically to the main curve of the Schiff spectrum. Our values are larger than Schiff's for heavy elements. The values we obtain agree well with values calculated by Jaeger for bremsstrahlung of 1 Mev peak energy (Nature *140* (1937), 108). Jaeger used exact Dirac wave functions in a numerical calculation. (2) The Schiff spectrum is essentially a one-atom spectrum and does not take into account the effect of the Betatron target thickness. We have considered the effects of multiple scattering and energy losses of the electrons in the target. An analytic formula for the thick target correction has been obtained by using approximate expressions for the multiple scattering distribution and the electron straggling distribution. The effect (1) is found to be the more important of the two. Owing to the difficulty of making measurements in the high photon energy region, previous measurements of the distribution in energy of the bremsstrahlung (for example, those of Koch and Carter, Phys. Rev. *77* (1950), 165) do not disagree with the larger values for high Z which have been calculated. However, experimental results obtained at the University of Saskatchewan on the $D^2(\gamma, n)$ reaction seem to substantiate these corrections.

65. Ionization Bursts at 10,700 Feet Altitude. By Hugh Carmichael, F.R.S.C.

Bursts have been measured in a thin-walled, spherical 8-inch diameter, pressurized ion-chamber at Echo Lake, Colorado. The measured sizes extended over a range of more than three decades and this enabled the size-frequency distribution curve to be analysed into five components representing respectively the bursts directly produced by single μ-mesons, single electrons, single protons, stars, and extensive showers. Four of the components proved to be closely similar in shape to those found (H. Carmichael and J. F. Steljes, Phys. Rev. *99* (1955), 1542) near sea level but the star distribution contained relatively more large bursts. The μ-mesons, electrons, protons, and extensive showers, respectively, increase with altitude about 2, 6, 15, and 17 times between 977 mb and 678 mb pressure.

66. The Sudden Increase in Cosmic Ray Intensity of February 23, 1956. By D. C. Rose, F.R.S.C. and J. Katzman.

An unusual sudden increase in cosmic ray intensity occurred on February 23 at approximately 0350 G.M.T., this being the first such increase since November 19, 1949. It was, as others in the past have been, associated with a solar flare. The intensity change at Ottawa was recorded on two neutron monitors and a large cubical counter telescope. The increase in intensity of the hard component (shielding about 13.0 cm. lead equivalent) was 11 per cent. With shielding of about 1.1 cm. lead equivalent, it was 28 per cent and in the case of the nucleon component, the intensity went up by a factor of 28. This increase is the first for which the nucleon component was recorded but the hard component increase at Ottawa was small in comparison to the increase of November 19, 1949. A counter telescope at Resolute in the Canadian Arctic also showed an increase of 18 per cent in the hard component. Reports are being received from various other laboratories throughout the world also showing this increase.

67. Auger Electron Emission in the Energy Spectra of Secondary Electrons from Molybdenum and Tungsten. By G. A. Harrower. Presented by B. W. Sargent, F.R.S.C.

Measurements of the energy distribution of secondary electrons made with high amplification reveal a considerable amount of fine structure characteristic of the target material. This fine structure observed for molybdenum and tungsten can be explained in terms of Auger emission processes. The energy levels possibly involved in Auger processes can be ascertained by combining measurements of inelastically reflected electrons and X-ray data. Auger energies calculated from certain of the levels determined in this way agree well with the fine structure details observed experimentally for both molybdenum and tungsten.

68. A Magnetic Pair Spectrometer and its Application to the Bremsstrahlung Spectrum produced by 70-Mev Electrons. By A. J. Goodjohn and B. W. Sargent, F.R.S.C.

The X-ray spectrum from the Queen's University synchrotron was analysed by a pair spectrometer capable of producing uniform magnetic fields up to 17,000 gauss in a volume 12 inches in diameter and 3 inches thick. A 1-mil gold foil was used as target. The pairs were detected after 180-degree deflections by two anthracene crystals and photomultipliers operating into amplifiers and a coincidence circuit with a resolving time of 10^{-8} sec. The photon distribution was obtained from counting rates and the differential pair cross-sections integrated over accepted ranges of angle and energy. Partial agreement with Schiff's calculated spectrum is seen.

69. Measurements of the Velocity Dependence of Cerenkov Radiation Intensity. By E. P. Hincks and C. H. Millar. Presented by L. G. Elliott, F.R.S.C.

The Cerenkov light pulses produced by fast μ-mesons $(+, -)$ in a 5-inch thick block of Plexiglas have been measured using a 30-channel pulse height analyser. The velocities of the mesons, determined from their ranges, extended from $\beta = 0.83$ to $\beta > 0.9997$ (meson energies 0.1 to >4 Bev). The results complement those of Winckler *et al.* (Phys. Rev., *98* (1955), 1411) and agree with classical theory predictions. In particular, the most probable light intensity reaches saturation at $\sim\beta = 0.997$ and remains constant to within <1 per cent up to $\beta > 0.9997$. There is no anomalous increase such as reported by Bassi *et al.* (Nuovo Cimento *9* (1952), 861).

Tuesday, 2.00 p.m. Papers 70–76.

70. Mass Spectrometrically Determined Independent Yields of I^{128}, I^{130}, Br^{80} and Br^{82} for U^{233}, U^{235} and Pu^{239} Fission. By T. J. Kennett and H. G. Thode, F.R.S.C.

The primary yields of the shielded nuclei I^{128} and I^{130} have been accurately determined for the thermal neutron fission of U^{233}, U^{235} and Pu^{239}. This has been done by the measurement of their stable daughters Xe^{128} and Xe^{130} using sensitive mass spectrometric techniques. The values of these primary yields show marked deviations from those predicted by the present theories of charge distribution. This discrepancy can be explained if the effect of the 50 proton shell is taken into account in the evaluation of the most probable initial nuclear charge Z_p for mass numbers 128 and 130. This can be done by postulating a most probable charge which will yield the greatest energy release in the fission process.

Also the primary yields of Br^{90} and Br^{92} were determined by means of their daughters Kr^{90} and Kr^{92} for the thermal fission of U^{233} and U^{235} and for the fast fission of Pu^{239}. The yields of these nuclei for fast neutron fission were ~100 times those for thermal fission, indicating a shift in the charge distribution curve with neutron energy.

71. The Decays of Praseodymium and Cerium of Mass 137. By G. T. Danby, A. L. Thompson and J. S. Foster, F.R.S.C.

The product $Ce^{140}(p, 4n)Pr^{137}$ has been observed (Dahlstrom, McGill thesis 1953) with a half-life of 1.5 hours. It is now found that this isotope decays to an unreported ground state of Ce^{137} by positron emission (E_{max} 1.8 mev) and by electron capture in the approximate ratio 1:5.

The ground state of Ce^{137} decays by electron capture with a half-life of 9 hours, mainly to the long-lived ground state of La^{137}, but also in amount 2.3 per cent to a 440 kev level in La. The main point is that these observations do not reveal the 254 kev gamma ray by which Ce^{137} had previously been identified.

However, the reaction $La^{139}(p, 3n)Ce^{137}$ does produce, in addition to the ground state, an isomeric level at 254.5 kev which decays by an M4 transition with the well-known half-life of 34.1 hours to the Ce^{137} ground state. There is, however, a 0.1 per cent branching to a multiple level near 800 kev in La^{137}.

72. The Microwave Spectra of ClCN and SCO in the 8 mm. region. By J. F. Mathison. Presented by J. S. Foster, F.R.S.C.

The microwave spectra of cyanogen chloride and carbonyl sulfide have been investigated in the 8 mm. region. The following isotopic species have been observed in their natural abundance:

Species	Abundance	Frequency, γ_0 in mc/s $J = 3 \leftarrow 2$
ClCN		
35–12–14	74.3%	35,824.83 ± 0.06
37–12–14	24.2	35,083.29 ± 0.07
35–13–14	0.832	35,638.49 ± 0.03
37–13–14	0.272	34,888.10 ± 0.02
35–12–15	0.272	34,488.32 ± 0.02
37–12–15	0.089	33,818.57 ± 0.04
SCO		$J = 3 \leftarrow 2$
32–12–16	93.81	36,488.858 ± 0.006
32–13–16	1.06	36,371.502 ± 0.006
33–12–16	0.73	36,029.328 ± 0.008
34–12–16	4.16	35,596.905 ± 0.005

The spectrum of ClCN is complicated by nuclear electric quadrupole–quadrupole interactions. This is observed as a general broadening and asymmetry of the chlorine hyperfine lines. In one case the N^{14} hyperfine structure of a chlorine hyperfine line has been resolved and measured, yielding a molecular quadrupole coupling constant of -3.32 ± 0.07 mc/s.

An approximately linear decrease in the quadrupole coupling constant as a function of excited vibration state to $v_2 = 2$, has been observed in both principal isotopic species of ClCN.

Fermi resonance perturbations in both ClCN and SCO have been studied.

73. Some Isotopes of Tantalum and Tungsten. By T. J. Rock. Presented by J. S. Foster, F.R.S.C.

It has recently been found that the known product $Ta^{181}(p, 3n)W^{179}$ (G. Wilkinson, Phys. Rev., *80* (1950), 495) decays with a longer half-life (40 min.) and also that it emits a strong 30 kev gamma ray. The isomeric state W^{179m} (5.2 min.) suggested by Wilkinson receives some support through a newly observed 222 kev gamma ray which appears to be converted in tungsten and decays with a period of about seven minutes.

The *L* conversion line of the 93 kev gamma ray in 8 hr. Ta^{180} (H. N. Brown *et al.*, Phys. Rev., *84* (1951), 292) is observed eventually to go into a half-life of many days. The possibility of an isomeric state Ta^{180m} is being examined.

74. The Angular Correlation in the Beta Decay of the Neutron. By J. M. Robson. Presented by L. G. Elliott, F.R.S.C.

The experiment on the angular correlation in the beta decay of the neutron, which was described at the last meeting, has been continued and additional results have been obtained for those electrons emitted at $173° \pm 7°$ from the proton recoil direction. These results are in agreement with those obtained previously at $160° \pm 10°$ and give additional direct confirmation of the relative strengths of the Scalar and Tensor interactions which can be deduced from the properties of other allowed beta transitions. The latest results for the angular correlation and for the strengths of the beta decay interactions will be presented.

75. The Reactions Induced by He^3 Bombardment of Be^9 and C^{12}. By D. A. Bromley, E. Almqvist, A. J. Ferguson, H. E. Gove, A. E. Litherland and E. B. Paul. Presented by L. G. Elliott, F.R.S.C.

The (He^3, p) and (He^3, n) excitation curves have been measured for both Be^9 and C^{12} targets. Proton angular distributions from C^{12} vary rapidly with energy while those from Be^9 are essentially independent of energy in the range 1 to 2.5 Mev. The angular distributions of the neutrons to the O^{14} ground state, which is the analogue of the 2.3 Mev state in N^{14}, are quite similar to the corresponding proton distributions. Relative yields of these protons and neutrons have been measured at several energies. A study of the gamma radiation associated with the $C^{12}(He^3, p)N^{14*}$ reaction resulted in a branching ratio of the 3.9 Mev state in N^{14} of 4.3 ± 0.8 per cent to be compared with a predicted value of about 1 per cent (J. P. Elliott, private communication and TPP-6, A.E.R.E., Harwell).

76. Ortho-Para Positronium Conversion in Aqueous Solutions. By R. E. Bell, F.R.S.C., and R. E. Green.

Measurement of the time distribution of positron annihilations in aqueous solutions of various substances gives information on ortho-para positronium conversion by the solute. Many simple ions show little or no conversion effect (H^+, Na^+, Ca^{++}, Cl^-). The paramagnetic transition group ions Cu^{++}, Co^{++}, and Fe^{+++}, having respectively 1, 3, and 5 unpaired electrons, show large conversion cross-sections up to one-tenth of the ionic geometrical cross-section, but the cross-sections appear to increase in the order Co^{++}, Cu^{++}, Fe^{+++}. The diamagnetic ion Zn^{++} which closes the transition group shows no conversion effect. The ions NO_2^- and NO_3^- have weak and apparently complicated conversion effects.

GENERAL PHYSICS

Tuesday, 9.00 a.m. Papers 77–86.

77. Photo-Electric Scanning of Fabry-Perot Fringes. By D. S. Smith. Presented by L. E. Howlett, F.R.S.C.

Very precise and convenient measurement of wavelengths and wavelength shifts is made possible by a method of photo-electric scanning of the fringes of the Fabry-Perot interferometer which has been developed in the interferometry section of the National Research Council. The usefulness of this technique will be illustrated by reference to the results of measurements of the pressure shift of the visible spectrum of Hg 198. A modification of the method whereby the shape of spectral lines can be investigated will also be described.

78. On the Redefinition of the International Metre. By K. M. Baird. Presented by L. E. Howlett, F.R.S.C.

In October of 1954 the Tenth General Conference of Weights and Measures accepted in principle the adoption of a wavelength of light as the basis for the new definition of the international metre. In connection with this decision, experiments are now in progress in various national and other laboratories in an effort to discover and to measure some optical wavelength which can be known to much better than ordinary spectroscopic accuracy, perhaps to better than one part in 10^9.

This paper discusses the relative merits of sources under consideration at present, viz, lamps containing single isotopes of Cd, Hg, or Kr, and also considers the importance of new techniques such as atomic beam methods in establishing the most precise standard.

79. An Improved Apparatus for Relative Gravity Determinations. By L. G. D. Thompson. Presented by A. D. Misener, F.R.S.C.

A description of the development and construction of a bi-pendulum apparatus for relative gravity measurements is presented. Interchangeable pairs of bronze half-second pendulums are swung in anti-phase in a temperature-controlled aluminum case. The arrangement permits the measurements to be performed under essentially identical conditions at all stations. Uncertainties due to magnetic effects, to temperature and pressure variations, and to the sway of the supports are therefore largely eliminated.

80. A Search for Analogies between Lunar and Terrestrial Topography on Photographs of the Canadian Shield. By C. S. Beals, F.R.S.C., G. M. Ferguson, and A. Landau.

Attention is drawn to the correlation between lunar craters and terrestrial meteorite craters and evidence is reviewed attributing to them similar origins.

Previous discoveries of Canadian craters in Quebec, Labrador, and Ontario are discussed and the suggestion is made that a search in Canadian Shield areas might well yield further examples.

A study of Canadian aerial photographs has revealed nine craters or crater-like objects. Four of these are tentatively attributed to volcanic action and it is suggested that the remaining five may have been due to meteorite impact. Two of the craters have been filled with Palaeozoic sediments.

81. Platinum-Rhodium Thermocouple Tables. By T. M. Dauphinee and C. S. M. Kirby. Presented by L. E. Howlett, F.R.S.C.

It has been found possible to describe the differences between the E.M.F.'s of platinum-rhodium thermocouples over the whole range of usefulness in terms of the sum of a deviation varying linearly with temperature and a function of rhodium content. Only two comparison points are required to determine the constants for any particular thermocouple. New thermocouple tables are being prepared representing the average linear and rhodium content terms of the different manufacturers selling wire in Canada.

82. Reproducibility of the Platinum Resistance Thermometer Scale. By E. H. McLaren. Presented by L. E. Howlett, F.R.S.C.

The International Temperature Scale between 0° C and 660° C is defined in terms of the platinum resistance thermometer using empirical relations for the interpolation between the three fixed points. In the upper part of this range the freezing points of tin, cadmium, and zinc have been found to be reproducible to within 0.0003° C, an order of magnitude better than the limit set by the accuracy of the sulphur fixed point. These freezing points, together with the steam point and water triple point, are being used to test the validity of the interpolation equations used in this range.

83. A Surface Temperature Detector. By T. M. Dauphinee and H. Preston-Thomas. Presented by L. E. Howlett, F.R.S.C.

The temperature of a moving surface with moderately high emissivity has been measured to $\pm 0.5°$ C by using an 8 junction thermopile with a radiation shield. The entire thermopile assembly is mounted in a 2.5 cm. $\times$ 2.5 cm. copper cylinder and shielded from daughts by a 0.5μ collection window at each end of the entrance cone. The radiation shield (a 20 cm. blackened disc) is controlled to the block temperature by a servo system. The detector is placed a few centimetres from the surface, the temperature of which is determined in terms of the block temperature, which is brought to within a few degrees of the surface temperature, and of the thermopile reading.

84. A Direct Reading Platinum Resistance Thermometer. By T. M. Dauphinee and H. Preston-Thomas. Presented by L. E. Howlett, F.R.S.C.

This instrument has been developed in response to a demand for a recording thermometer capable of operating at the end of several hundred feet of cable and having an accuracy of 0.005° C and a discrimination of 0.001° C. A platinum resistance thermometer is placed in series with a four terminal resistance box and the difference in E.M.F.'s across the two is presented to an amplifier and recorder by means of an isolating potential comparator. The resistance box is so constructed that its 104 position switch reads directly in degrees from $-2°$ C to 102° C, the fractions of a degree being read linearly off the recorder.

85. Electrical Conductance Mechanisms in Liquid Semi-Insulators. By John Hart and A. G. Mungall. Presented by J. T. Henderson, F.R.S.C.

Inconsistencies of measurements of the D.C. conductivity of polar liquids in the range 10^{-9} to 10^{-12} ohm^{-1} cm^{-1} have hitherto been almost unrecognized; now a careful experimental technique has led to results that are relatively self-consistent. It appears that for

liquids which by any ordinary criterion are pure, electrode effects cause inconsistent changes in conductance which had previously been partially attributed to the low mobilities of the conductance ions. As the purity of the liquid is successively increased, there is improved consistency in the results, until a low value of conductance appears which is almost independent of the nature of the electrode materials: this is the true conductance of the specimen in a highly purified condition. Current–time curves are plotted whose shape can only partially be explained in terms of existing theories.

86. Primary A.C. Power Measurements at the National Research Council. By John Hart. Presented by J. T. Henderson, F.R.S.C.

A.C. power measurements are usually thought to be in the province of the electrical engineer, rather than the physicist. For a primary measurement, however, the alternating quantity is expressed in terms of a similar direct quantity which has itself been derived from the primary units of mass, length and time, and this ac/dc transfer involves very careful physical measurements. The apparatus now being set up at the Council for making such measurements is described, and the theoretical and practical problems of setting up a self-consistent system of "internal check" are discussed.

Tuesday, 2.00 p.m. Papers 87–94.

87. Use of Infrared Oblique Photographs in Aerial Triangulation. By U. V. Helava. Presented by L. E. Howlett, F.R.S.C.

The adjustment of transversal curvature (the y co-ordinates) in an aerial bridging presents a difficult problem. It seems that the method using oblique infrared photographs made fore and aft along the flight line will be an economical and efficient solution. A suitable tilt angle and use of infrared film make it possible to cover a long portion of terrain with each single oblique photograph. A straight line is constructed on the oblique diapositives throughout the triangulation strip and the position of a number of points is established by applying corrections for earth curvature, atmospheric refraction, topography, and lens distortion.

88. Airborne Controlled Method of Aerial Triangulation. By T. J. Blachut. Presented by L. E. Howlett, F.R.S.C.

The main problem in photogrammetric mapping is the extension of ground control. Owing to the complexity of this problem a satisfactory solution has met with various difficulties. A method developed by the Photogrammetric Research group seems to open new possibilities in this field. Airborne profile recorder data are incorporated into instrumental procedure of aerial triangulation. As a result it is possible to determine with a high degree of accuracy the x and z co-ordinates of photogrammetrically established points. Infrared oblique photographs are used for the control of y co-ordinates.

An experimental aerial triangulation carried out over a distance of 210 miles, revealed the following accuracy (expressed in mean square errors):

$$m_x = \pm 2.4\ m$$
$$m_z = \pm 6.4\ m$$
$$m_y = \pm 8.0\ m.$$

89. Analytical Aerial Triangulation. By G. H. Schut. Presented by L. E. Howlett, F.R.S.C.

The analytical aerial triangulation is a new photogrammetric method of densifying the number of ground control points used in mapping from aerial photographs.

The method involves the reading of photographic co-ordinates of the required points followed by computation on an electronic computer.

For a number of reasons it will be more accurate than the instrumental triangulation now commonly used for this purpose.

The computational procedure developed at the National Research Council of Canada and the result of a triangulation of a strip of 35 photographs are described.

90. The Apparent Intensities of Coloured Signal Lights. By W. E. Knowles Middleton, F.R.S.C., and Hanna T. Gottfried.

It has been known for some time that the apparent brightness of surfaces of highly saturated colours cannot be computed by means of the standard C.I.E. luminosity function. The present work is an extension to point sources of coloured light against a dark background. It is found that the departure from the theoretical intensity varies widely with the position of the colour in the chromaticity diagram. The effect is by no means negligible, a deep red signal having about twice the calculated intensity when matched with a white signal of about 60 times threshold.

91. Theoretical Investigation of Coloured Lenses for Snow Goggles. By Gunter Wyszecki. Presented by W. E. Knowles Middleton, F.R.S.C.

Safe driving in the "arctic whiteout" depends upon the early detection of sudden changes of elevation and holes in the snow field. It has been thought that coloured glasses ought to help. The present investigation reveals no significant objective superiority of coloured glasses over those which are essentially neutral.

92. Radiation Efficiency of a Linear Array of Point Sources with Periodic Phase Variation. By G. J. Thiessen and T. F. W. Embleton. Presented by L. E. Howlett, F.R.S.C.

The phase of the sources in the array is considered to vary in a "zig-zag" manner with distance from the end. It is found that the phase must vary along the length of the source at a rate which is at least equal to that in the radiated wave before an appreciable decrease in radiation efficiency occurs. If the sources are excited by means of pulses whose timing varies periodically along the length of the array then it becomes impossible to make the source inefficient for all frequencies.

93. Radiation Efficiency of a Linear Array of Point Sources with Linear Phase Variation. By G. J. Thiessen and T. F. W. Embleton. Presented by L. E. Howlett, F.R.S.C.

As soon as the rate at which the phase varies along the length of a linear array of point sources exceeds that which occurs in the wave in the medium the efficiency begins to drop

rapidly. Since it is a periodic function of the phase shift only bands of frequencies can be suppressed when the excitation is of the kind occurring in paper mill suction rolls. Noise reduction of more than 20 db. can be obtained by proper choice of drill patterns.

94. The Low Frequency Attenuation of Cover Type Ear Defenders in relation to the Flesh Impedance. By E. A. G. Shaw and G. J. Thiessen. Presented by L. E. Howlett, F.R.S.C.

The lumped constant theory has been extended to take into account the finite area of contact between cushion and head. The physical attenuation measurements have been developed to permit determination of both the amplitude ratio and the phase shift in transmission, making it possible to calculate the flesh impedance at frequencies between 30 and 500 cps. The preliminary values of stiffness and resistance (8×10^7 dyne-cm^{-1} and 3×10^5 dyne-sec. cm^{-1}) are, respectively, six times less and ten times greater than the magnitudes of corresponding mastoid parameters recently determined by other authors.

Wednesday, 9.00 a.m. Papers 95–104.

95. The Spreading of Non-Volatile Liquids in Paper. By T. Gillespie. Presented by G. O. Langstroth, F.R.S.C.

An attempt has been made to understand the process by which drops of low vapor pressure liquids spread in paper to form stains. Both the rate of spreading and the distribution of liquid in a variety of stains have been measured at various times. The results can be explained on the basis that the paper acts as a network of capillaries in which the flow is governed by a modified version of Poiseuille's Law which takes into account electroviscous forces.

96. Rock Shattering by High Explosive. By M. S. Macphail, F.R.S.C.

For a spherical charge of explosive in an infinite solid medium a relation is found between the force of the explosion, the strength of the medium, and the radius of shattering. Under certain assumptions it appears that if a force F is applied to the inner surface of a cavity of radius r_0, the force at distance r consists of a steady state Fr_0^2/r^2 and a transient of peak value Fr_0/r. Estimating from classical closed bomb theory the pressure F for TNT at density 1.0 to be 40 kilobars, and the compressive strength of granite 1.5 kilobars, we obtain $5 < r_1/r_0 < 27$, where r_1 is the radius of shattering. Bomb observations suggest $r_1/r_0 = 10$, roughly. The inequality could be improved if more were known about the resistance of rock to transient stresses.

97. Some Factors Affecting the Kinetic Friction of Ice. By C. D. Niven, F.R.S.C.

In addition to temperature and loading, it has been found that speed affects the kinetic friction of ice. Thus most of the accepted laws governing friction fail when applied to ice, and a family of graphs rather than a single constant is needed to completely specify the kinetic friction. Heating the runner will reduce the friction only slightly. The wetability of the runner is a highly important factor at low temperature.

98. An Unusual Glow Discharge Obtained during High Vacuum Breakdown Studies. By A. S. Denholm. Presented by D. W. R. McKinley, F.R.S.C.

During the course of a study on high vacuum breakdown at the Royal Technical College, Glasgow, an unusual glow discharge phenomenon, which does not seem to have previously been reported in the literature, was noted at pressures below 10^{-5} mm. Hg.

Only a cursory study was possible, but it was noted that the discharge took the form of a pulse, of a few milliamperes lasting some milliseconds, which occurred only with copper electrodes and was associated with the Apiezon oil with which the system was pumped. It seems likely that there is a relationship between the phenomenon and the catalysis of transformer oil by copper.

99. A Flat Front Impulse Generator. By C. A. E. Uhlig. Presented by D. W. R. McKinley, F.R.S.C.

The breakdown voltage of air at atmospheric pressure of a geometrically non-uniform field gap can very well be much larger for slowly varying or stationary voltages (60 cycle a.c. or d.c.) than for surges of normal steepness (10 to 100 KV/μs), if a thin wire is used as high-stress electrode instead of a point. To investigate this phenomenon, for which the author suggests the name "ultracorona," it was necessary to develop a flat front impulse generator from which are obtainable wave shapes of any steepness from 1.0 to 0.001 KV/μs, covering the range between industrial frequency sine wave voltages and normal surge voltages.

A number of possibilities of generating the desired wave shapes are discussed, and, in particular, a circuit consisting of a normal multi-stage Marx-generator to which an additional gapless circuit is added to produce the desired wave shape. Equations for the calculation are derived and problems occurring during the actual development of such a generator are discussed.

100. Dielectric Dispersion in Some Oxides. By Blodwen Thomas. Presented by D. W. R. McKinley, F.R.S.C.

The dielectric constant and loss tangent of most insulators are dependent on frequency and temperature. Measurements on some tin and cerium oxides in ceramic form show several regions of dielectric loss. Various mechanisms for this loss are considered, and activation energies of conduction and dielectric relaxation are calculated.

101. The Resistance of Metals below 1°K. By J. S. Dugdale and D. K. C. MacDonald. Presented by G. Herzberg, F.R.S.C.

In measurements of electrical resistivity and other properties below 1°K the most difficult problem has been, and remains, the establishment of adequate thermal equilibrium of specimen with paramagnetic salt. We have crystallized salts from solution directly onto the specimens and have measured the resistance of alkali metals, gold and copper down to about 0.05°K. The gold and copper specimens were both chosen to exhibit the anomalous resistive minimum (e.g., MacDonald and Pearson, Acta Met. *3*: 392, 403, 1955), with iron as the probably dominant impurity, but their behaviour below 1°K differs markedly the one from the other.

Attempts to use dilute copper-manganese alloys as cooling agent will also be reported on.

102. Magnetic Susceptibility of Metals at Low Temperatures. By F. T. Hedgcock. Presented by G. Herzberg, F.R.S.C.

The present programme on the susceptibility of metals consists of two main parts:

(1) The susceptibility of dilute copper alloys has been studied in the temperature region in which the alloys exhibit an anomalous resistive minimum. The measurements made to date, while supplying useful information about the resistive behaviour at these low temperatures, are also interesting from the point of view of alloy formation.

(2) The susceptibility of the alkali metals is being measured over an extended temperature range down to that of liquid helium. Theoretical development of the collective electron treatment, notably by Bohm and Pines, along with the recent measurements on the conduction-electron paramagnetic susceptibility in the alkali metals has led to a need for data on the total magnetic susceptibility of these materials. Particular reference will be made to measurements on rubidium (cf. also abstract by J. S. Dugdale—present conference).

103. Thermal Conductivity at Low Temperatures. By D. K. C. MacDonald, G. K. White and S. B. Woods. Presented by G. Herzberg, F.R.S.C.

A comprehensive study of the thermal (and electrical) conductivity of all the alkali metals down to about 2°K has been completed and is being published (White, Woods and MacDonald, Proc. Roy. Soc. Lond. A). A careful comparison has been made with the fundamental theory of electron-transport (Wilson, Mott and Jones *et al.*) and it is clear that no single choice of parameters (such as the characteristic (Debye) temperature) will produce satisfactory agreement. A new and rather simple semi-theoretical expression has been proposed for electron thermal conductivity which agrees surprisingly well with the present experiments and other available data.

Work has also commenced on a broad experimental study of the thermal conductivities of the inert gas solids, and data on solid argon is in publication (White and Woods, Nature, Lond.). Results on these simple insulating solids can be compared with the semi-quantitative expressions of Leibfried and Schlömann (Gött. Nach. IIa: 71, 1954) and Dugdale and MacDonald (Phys. Rev. *98*: 1751, 1955) and provide stimulus for continuing theoretical study of the fundamental problem of thermal conductivity in an insulating solid.

104. The Resistance of Rubidium under Pressure at Low Temperatures. By J. S. Dugdale. Presented by G. Herzberg, F.R.S.C.

The resistance of rubidium has been measured between 2°K and room temperature at pressures up to 2,500 atmospheres. In particular the residual resistance, which was found to increase under pressure, the low temperature thermal component of resistance, which diminishes under pressure, and the resistance in the neighourhood of the anomaly at $\sim$180°K (D. K. C. MacDonald, Phil. Mag. *43*: 479, 1952; F. M. Kelly and W. B. Pearson, Can. J. Phys. *33*: 17, 1955) have been the most intensively studied.

105. The Classification of Certain Semiconductors. By E. Mooser and W. B. Pearson. Presented by G. Herzberg, F.R.S.C.

A newly discovered series of compounds with the Al_2CdS_4 type of structure (M = 2, space group $I\bar{4}$) (Hahn *et al.*, Z. anorg. Chem. *279*: 241, 1955) are semiconductors (Busch, Mooser and Pearson, 1956). The structure of these compounds, in which the relative

atomic positions are similar to those in the chalcopyrites, will be discussed in relation to the structures of certain other semiconductors making use of the concept of the "semiconducting bond" (Mooser and Pearson, J. Electronics: 1956 Report of the Conference on Semiconductors held at Ashorne Hill and British Thomson-Houston, Rugby).

106. The Question of Correlation between Photons in Coherent Light Rays.

By H. I. S. Ferguson and E. Brannen. Presented by A. D. Misener, F.R.S.C.

R. Hanbury Brown and R. Q. Twiss, in England, have claimed that such a correlation exists. A. Adám, L. Jánossy and P. Varga, in Hungary, using a coincidence circuit of 2×10^{-6} seconds resolving time, have shown that less than 0.6 per cent of photons in coherent light rays act in an anomalous manner.

With a coincidence circuit of 10^{-8} seconds resolving time, and detecting the photons with 1P21 photomultipliers, we have shown that less than 0.01 per cent of such photons act in an anomalous manner, allowing for fluctuations up to 3 times the probable error. The effect of random coincidences is eliminated by inserting delays in one photomultiplier channel.

We believe that this method gives a more direct answer to the question than that given by the previous methods.

INDEX

Light-face figures indicate the number of the article, bold-face figures the number of the page.

SECTION IV. GEOLOGICAL SCIENCES

Monday, June 11

11.00 A.M.—Meeting of the Section.

1. Presidential Address by J. E. Hawley, F.R.S.C.

2.00 P.M.—Meeting of the Section.

2. New Discoveries of Miocene Vertebrates in Saskatchewan. By Loris S. Russell, F.R.S.C.

The wood Mountain gravel of southern Saskatchewan has yielded a small series of mammalian teeth and bones, which have been dated as Middle or Late Miocene. During the field season of 1955, new road cuts in Wood Mountain beds in the vicinity of Rock Glen yielded a relatively large collection of fossil vertebrates, which greatly increases our knowledge of the fauna. Rodents, carnivores, horses, camels and antelope, previously known from isolated teeth, are now represented by jaws with good dental series. The lower jaw of a gomphothere, one of the earliest proboscideans in North America, was the most striking discovery. A large land tortoise is represented by numerous plates of the shell.

3. The Importance of Bonebeds. By Wann Langton, Jr. Presented by Loris S. Russell, F.R.S.C.

Bonebeds are local accumulations of osseous remains derived from several individuals often of different species. Geologically they comprise minor, but stratigraphically useful lithologic features of sedimentary deposits. The belief that bonebed excavation is unprofitable is fallacious; bonebeds often provide knowledge of extinct animals available from no other source. Bonebeds give the largest samples of practically contemporaneous vertebrates, and the broadest cross-sections of extinct faunas. Bonebed material furnishes the soundest basis for statistical studies of intraspecific variation, and constitutes the best source of supplementary anatomical data. Small specimens are more likely to be noticed in bonebed excavation than during the usually rapid reconnaissance of extensive outcrops. Bonebed assemblages permit rapid and refined age determinations by stratigraphic vertebrate palaeontologists. Theoretically the statistical requirement for random sampling demands recovery of every specimen from a bonebed (itself merely a random sample). This is impossible in most cases. Detailed notes and accurate identification of all material not collected provides the only acceptable substitute.

4. *Solenopora canadensis* (Foord) and Congeneric Algae from the Ordovician of Canada. By G. Winston Sinclair. Presented by J. F. Caley, F.R.S.C.

The name *Solenopora compacta* (Billings) has been widely used for a calcareous alga which forms subspherical masses in Middle Ordovician rocks. Billings did not figure his species, but it was almost certainly a stromatoporoid, not an alga. Foord's name *S. canadensis* is available, and probably should be applied to most of the Trenton algae which have been recorded as *S. compacta*. Foord's species and a few others are described, and the occurrence of the genus in the Middle and Upper Ordovician of eastern Canada is reviewed.

Section IV

5. The Problem of Finding More Geologists. By Harry V. Warren, F.R.S.C.

The need for more Geologists and Geological Engineers who may assist in the development of Canada is becoming increasingly evident.

The author suggests that neither salaries nor working conditions are at the root of this problem. Our young people in that period of their life when they are thinking of choosing a career should be given an opportunity of learning of the satisfying and challenging career which Geology has to offer them. This opportunity should be presented during high school days. By the time a student has reached a university he may already have decided on a career.

6. The Chemical Composition of the Grenville and Southern Part of the Timiskaming Subprovinces in Quebec. By F. Fitz Osborne, F.R.S.C.

New analyses of rocks and clays from different parts of Quebec show that the differences in composition of rocks in the Grenville and Timiskaming subprovinces are not so great as has been suggested if proper weight is given to mode of occurrence of the rocks analysed.

7. Dating Cordilleran Orogenies. By A. J. Beveridge and R. E. Folinsbee. Presented by P. S. Warren, F.R.S.C.

Potassium-argon dates for a number of volcanic and plutonic igneous rocks from the North American Cordillera suggest that the principal period of Mesozoic intrusion may be late Cretaceous (Laramide) rather than Jurassic (Nevadan).

Sanidine from the Crowsnest volcanics, Alberta, of Albian-Cenomanian age, gave a potassium-argon age of 96 m.y. Two samples of granitic rocks and a feldspar phenocryst from the Sierra Nevada batholith, California, gave ages of 88, 72, and 68 m.y., similar to a 71 m.y. age obtained for orthoclase from the Boulder batholith, Montana.

A study of heavy mineral residues from the Cretaceous sedimentary section suggests, however, that a pre-Laramide group of granitic intrusives was present in the Cordilleran area. The age of zircon separated from the Nelson batholith, British Columbia, indicates that it may have been one of these early plutons.

8. Second Annual Report of the Committee on Precambrian and Related Dating. By R. M. Farquhar, Secretary. Presented by J. B. Mawdsley, F.R.S.C.

This report presents a brief review of papers dealing with recent events in the field of radioactive dating of Precambrian rocks and minerals, with special reference to the Precambrian of Canada. New developments in methods of analysis and the results obtained are described, and the table of available age determinations is supplemented.

Tuesday, June 12

9.00 A.M.—Symposium on "The Proterozoic in Canada."

9. Proterozoic in Canada. By J. M. Harrison, F.R.S.C., and K. E. Eade.

The use of the term Proterozoic is reviewed in some detail, with the emphasis on the last twenty-five years, and especially in the light of present knowledge and speculation. It is apparent that the term means different things to different geologists but that, fundamentally, the difference is small. Suggestions are made for considering possible future use of the term.

10. The Proterozoic Stratigraphy of the Canadian Arctic Archipelago and Northwest Greenland. By R. G. Blackadar. Presented by Y. O. Fortier, F.R.S.C.

In recent years, field parties of the Geological Survey of Canada have mapped new regions of probable Proterozoic rocks in the eastern Canadian Arctic. The Proterozoic stratigraphy of Greenland is discussed and these new areas are compared to it. Broadly speaking, the sequence of deposition of these rocks began with the deposition of relatively pure quartzose sandstone which was followed by the deposition of dolomite; the youngest known Proterozoic rocks are mudstones, siltstones, and shales. Commonly the strata comprising these assemblages are brilliantly coloured. The Late Precambrian rocks of the western Canadian Arctic comprise dolomite, sandstone, and lastly a great thickness of volcanic rocks. On the basis of available evidence the author suggests that there were several relatively shallow basins of deposition in the eastern part of the Arctic during Proterozoic times and that the depositional history was similar but not identical in these. The depositional history proposed by O'Neill for the Victoria Island trough in the western Canadian Arctic is given as no new information is available for this region.

11. The Southern End of the Labrador "Trough" and the Seal-Croteau Groups of Labrador. By W. F. Fahrig. Presented by I. W. Jones, F.R.S.C.

This paper outlines the major geological facts of two areas of Proterozoic rocks in Quebec and Labrador. The areas discussed are the southern portion of the Labrador "Trough" and the area of Labrador underlain by the Seal and Croteau groups.

A one-inch to ten-mile geological compilation provides a partial summary of the geology of part of the Labrador "Trough." This map shows the major tectonic axes, thrust and normal faults, and the gross distribution of stratigraphic and lithologic units. The boundaries of the Labrador "Trough" are discussed with particular emphasis on the eastern boundary. Evidence is presented which indicates that the metamorphic rocks east of the "Trough" are in reality metamorphosed Proterozoic ("Trough") strata.

The stratigraphy in the Knob Lake section is interpreted in terms of marine transgressions and regressions. A remarkable zone of sedimentation trending east-west is described in the Cambrian Lake section of the "Trough." This structure is interpreted as indicating the presence of great local relief just prior to the downwarping which initiated sedimentation in the Labrador "Trough" area.

The Seal and Croteau groups of Labrador are briefly described. Evidence is presented on the stratigraphic relationship between the two groups.

The possibility of correlation between various Proterozoic rock units of Labrador and Quebec is briefly considered.

12. Proterozoic Rocks of the Northern Part of the Labrador Geosyncline, the Cape Smith Belt, and the Richmond Gulf Area. By Robert Bergeron. Presented by I. W. Jones, F.R.S.C.

This paper outlines the major features of the geology of three areas of Proterozoic rocks in Ungava. The sequences of rocks are briefly described and their structure, metamorphism, and relationships to older Precambrian rocks are briefly considered. The eastern boundary of the Labrador geosyncline is discussed.

Correlation of the rocks in the three separate areas would seem to indicate that the sediments were laid down in what may have been one continuous trough during Proterozoic

time. Most of the northwestern part of the Province of Quebec was therefore a land-mass relatively free of tectonism for a long period before the deposition of Proterozoic sediments around most of it. Most of the clastic sediments deposited in the trough were not derived from this land-mass, although it was probably the source area of the iron formations. The long period of stability favoured a very mature weathering permitting the rivers of the land-mass to carry a large quantity of iron to the surrounding Proterozoic seas.

13. Late Precambrian Rocks of the North Shore of the St. Lawrence River and of the Mistassini and Otish Mountains Areas, Quebec. By Robert Bergeron. Presented by I. W. Jones, F.R.S.C.

This paper outlines the major geological features of three sequences of late Precambrian rocks in Quebec: the Wakeham, Mistassini, and Otish Mountains groups. Their stratigraphy, structure, metamorphism, and relationships to older Precambrian rocks are briefly discussed.

The mutual relationships of the Mistassini and Otish Mountains groups, and the possibility of correlating the three groups with Proterozoic rocks of the Labrador geosyncline, are briefly considered.

14. The Quirke Lake–Elliot Lake Sector, Blind River Area, Ontario. By S. M. Roscoe. Presented by C. S. Lord, F.R.S.C.

Numerous deep drill holes in Townships 143, 144, 149, and 150 provide much data on the sedimentary sequence and on variations in thickness and in facies of Huronian rocks underlying the Gowganda formation. The direction of transport of the clastic sediments, as shown by thickening of the sequence, diminishing grain size, and original dip of cross-bedding, was from the northwest towards the southeast. The lowermost unit, which contains uraniferous quartz pebble conglomerate, is considered to have been laid down as an alluvial deposit. Evidence for a major erosional unconformity between the Bruce Series and the Cobalt Series is inconclusive.

15. Proterozoic of the Port Arthur and Lake Nipigon Regions, Ontario. By W. W. Moorhouse. Presented by G. B. Langford, F.R.S.C.

A brief description is given of the Animikee and Keweenawan sediments of the Thunder Bay area, with particular reference to the Gunflint iron formation and the Rove slate. It is shown that the Animikee rocks were probably deposited in a brackish, marine basin, in waters of shallow to moderate depth, in the absence of terrigenous sediment. The igneous history of the area is discussed and an outline of the principal structural features is given.

The Animikee is separated from the older rocks by a major angular unconformity. Although there is evidence of a considerable erosion interval between the deposition of the Rove slate (Animikee) and the Sibley (Keweenawan), the angular discordance between them is slight.

2.00 P.M.—Symposium on "The Proterozoic in Canada" (*cont'd*).

16. The Questionable Proterozoic Rocks of the Sudbury-Espanola Area. By J. E. Thomson, F.R.S.C.

Recent studies by the writer and his associates have shown that rock formations throughout the Sudbury-Espanola area, which were previously classified as Huronian and Keweenawan in age by some geologists, may be Early Precambrian. The great unconformity be-

tween the Early and Late Precambrian, which is so well marked at Cobalt and Blind River, has not yet been found in this area, and complex folding, faulting, and intrusion add to the stratigraphic problems. A detailed restudy of the Sudbury-Espanola belt is in progress and it is recommended that current time-stratigraphic terminology be discontinued until the fundamental rock-stratigraphic relationships are better established.

17. Proterozoic Rocks of the North Shore of Lake Huron from Gladstone to Spragge Townships. By E. M. Abraham. Presented by J. E. Thomson, F.R.S.C.

The area is underlain by rocks ranging in age from Keweenawan to pre-Huronian. The sedimentary rocks are flat-lying to steep-dipping, and represent the nose and south limb of a broad westerly plunging anticline. Easterly trending faults traverse the area. The most important of these is the Murray fault, which in Bright and Thomson townships has faulted the pre-Huronian basement granite over the Cobalt sediments. North of the fault zone the Cobalt sediments have been intensely folded and crenulated. Similar but smaller parallel thrusts also exist. Later northeast and northwest trending faults transect the entire area.

18. Proterozoic Rocks of the Cobalt Area. By Robert Thomson. Presented by M. E. Hurst, F.R.S.C.

At Cobalt an angular unconformity separates rocks of Proterozoic age from early Precambrian volcanics and sediments. Proterozoic rocks consist of the Cobalt series, comprising the Coleman, Firstbrook, and Lorrain formations, the first of glacial origin, the latter of lacustrine origin, intruded by the Nipissing diabase. The Cobalt series was deposited in trough-like depressions and has been relatively undisturbed by folding; the strata are intersected by faults, some of which may be related to the "Grenville front." The diabase is sill-like and dike-like in shape; the sheet was emplaced in the form of arches and basins. A local orifice probably fed diabase magma to each basin.

19. Proterozoic Rocks of the Northwest Territories. By I. C. Brown and G. M. Wright. Presented by J. F. Henderson, F.R.S.C.

The area discussed in this paper covers the mainland part of the Northwest Territories from Great Slave and Great Bear Lakes to Hudson Bay and extends south to include the Lake Athabaska area.

The Proterozoic rocks are divided into four sub-areas for descriptive purposes, as follows: (1) Eastern Great Slave Lake to Lake Athabaska; (2) Great Slave Lake to Great Bear Lake; (3) Arctic Coast; (4) Eastern Mackenzie and Keewatin.

The Proterozoic rocks of each area are described and the structure, metamorphism, relations within each group, and relations to older and younger rocks are discussed. Proterozoic intrusions are described and the special problem of extent of Proterozoic granitic intrusions is considered. Correlation problems within the Northwest Territories are presented and related to the over-all problem of Proterozoic correlation.

20. The Proterozoic of Appalachian Canada. By L. J. Weeks, F.R.S.C.

The applicability of the term Proterozoic to the late Precambrian rocks of eastern Canada is discussed. The formational units are briefly described from east to west, and a correlation is attempted between those found in somewhat widely separated areas. Finally the tectonic and paleogeographic implications are discussed.

Section IV

21. The Proterozoic of the Cordillera in Southeastern British Columbia and Southwestern Alberta. By J. E. Reesor. Presented by H. C. Gunning, F.R.S.C.

The areal extent, iithological character, general structure, and metamorphism of the known Proterozoic succession and immediately overlying Cambrian rocks are briefly described. Problems of correlation are noted and correlation throughout the region is briefly summarized in the text and in Table I.

The Purcell System consists of approximately 45,000 feet of fine-grained, clastic sediments deposited under shallow water conditions in a slowly subsiding basin lying westward of the central North American Craton. This thick sequence of rocks had in part an eastern source, though in part it may well have been derived from either an eastern or a western source and from welts within the basin.

Deformation at the end of deposition of this sequence was followed by deposition of the unconformably overlying Windermere System and succeeding Cambrian rocks, all deposited under similar tectonic conditions. Evidence at present available indicates an eastern or southeastern source for all of these post-Purcell sediments.

Finally, on the basis of the tentative correlations presented here, a composite reconstruction of sedimentation and deformation is attempted for this region.

22. Dating the Proterozoic of Canada. By R. D. Russell and R. M. Farquhar. Presented by J. T. Wilson, F.R.S.C.

The application of radioactive methods of age determination to the dating of Proterozoic type rocks is discussed, and the limitations of the methods outlined. Our present knowledge of the age relationships between Proterozoic and Archean rocks in the Canadian Shield as determined by radioactive methods is reviewed, and a preliminary Precambrian time-scale is presented which is based on available age data.

Wednesday, June 13

9.00 A.M.—Joint Session of Committee on Oceanography and Section IV. Symposium on "Ocean Floors around Canada."

23. Geophysical Observations concerning the History and Structure of Sable Island. By P. L. Willmore and R. Tolmie. Presented by C. S. Beals, F.R.S.C.

Seismic refraction observations along several lines in Sable Island indicate that the velocity characteristic of loose sand, which is the only material visible at the surface, is maintained to a depth of about 1,350 feet. At that depth the sand appears to give place to soft sedimentary rocks, extending downwards beyond the limit of measurement. These results are similar to those reported by Ewing and Officer on other parts of the Scotian Shelf, and suggest that Sable Island is built up by current and wind action rather than the surface expression of a tectonic feature.

A layer of decomposing vegetable matter has been found under the high sand dunes in many parts of the island. This is much more woody than the present flora of the dunes, and it is therefore suggested that settlement in historical times has had a profound effect on the vegetation, and hence on the stability of the island. In order to check this hypothesis, arrangements are being made to date the vegetable matter by the carbon-14 method.

24. The Transverse Troughs of Cabot Strait and the Strait of Canso. By Donald J. MacNeil. Presented by J. E. Hawley, F.R.S.C.

Profiles of the Cabot Strait Trough, a feature which has an average width of 60 miles and a maximum depth of over 1,700 feet along the portion of it discussed in this paper, have been drawn on the basis of fathometer readings. The waters of the Strait of Canso occupy a depression that is much smaller than the Cabot Strait trough, nevertheless both depressions are roughly parallel, and the origin of each has been ascribed by some geologists to faulting. If both of these troughs are down-faulted blocks, the trend of the faults is transverse to the strike of the major faults that have been recognized in Nova Scotia and Newfoundland. The fathometer results are interpreted as being opposed to the fault origin of both troughs.

25. Seismic Observations on the Structure of the St. Lawrence Gulf. By P. L. Willmore and A. E. Scheidegger. Presented by C. S. Beals, F.R.S.C.

As part of its programme of investigations of circular features of the Earth's crust, the Dominion Observatory collaborated with the Atlantic Oceanographic Group and the Nova Scotia Research Foundation in a seismic investigation of the Gulf of St. Lawrence. A pattern of depth charges was dropped in the sea, and the seismic waves observed by means of seismographs in New Brunswick, the Magdalen Islands, Prince Edward Island, and Nova Scotia. Compressional waves through the rock were observed at distances up to 450 km.

A least-squares method of treating the entire body of travel-time data is used to supplement the conventional method of reducing travel-times from the individual profiles.

A preliminary reduction of the results has indicated the existence of several kilometers of sediment over the Precambrian rocks beneath the Magdalen Islands and under the Cabot Strait. Substantially thinner sediments appear elsewhere.

26. Geological Unity of the Arctic Islands. By Y. O. Fortier, F.R.S.C., and L. W. Morley.

The Arctic Archipelago is geologically an integral part of the North American continent and its insularity derives from secondary and relatively recent processes.

The islands belong to a number of geological provinces, each of which encompasses many islands or parts of islands. These provinces and their arrangements are similar to others in more southern regions. The latter form together the framework of the North American continent and in that sense the Arctic Islands have geological unity. The insularity of the Archipelago thus appears to be the result of recent processes that have split a continuous land-mass and brought its segments in various relations to sea level. Fluvial action, crustal warping, and probably dislocation have been operative but the importance of each of these contributing factors has not been assessed. The geologist, the hydrographer, the physiographer, and the geophysicist can together elucidate the problem. Aeromagnetic surveys which help to trace the major geological provinces from island to island can detect evidence of local discontinuity in those cases in which the basement is involved.

27. Oceanographic Features of Submarine Topography. By H. B. Hachey, F.R.S.C., L. Lauzier, and W. B. Bailey.

The submarine topography in the western North Atlantic is dealt with in some detail. Submarine valleys extending into the continental shelf on the Canadian Atlantic coast are

described, and it is shown that the Laurentian Channel is an important feature in the phenomenon of the Gaspé Current. Submarine ridges in the Canadian Arctic are shown to be an effective barrier to the exchange of waters between east and west at the greater depths. The sill depths of submarine basins are shown to be of prime importance in determining the nature of the water masses in areas such as Baffin Bay.

28. The Ocean Floor and Water Movement. By R. W. Trites. Presented by H. B. Hachey, F.R.S.C.

The role which bottom topography can play in determining the nature and direction of water flow is reviewed. The ocean floor is visualized as affecting water movement in two ways: first, bottom elevations or depressions may limit the direction of flow and provide effective barriers separating water masses; secondly, for a given transport of water over an irregular bottom, the direction of flow may be affected by the bottom topography. Whether the direction of flow deviates or remains unaltered when passing over an elevation or depression in the bottom is found to depend on the transverse variation in the vorticity of the water column.

29. Physical Features of British Columbia Inlets. By G. L. Pickard Presented by H. C. Gunning, F.R.S.C.

In the British Columbia coast there are nearly forty inlets of 10 to 70 miles in length and 0.5 to 3 miles in width. The average depth is 1,000 feet with maxima of 2,400 feet. The sides are generally steep above and below water, and in the cases which have been studied the mud bottom is very flat. The depth at the seaward end is usually less than the maximum in the inlet but very shallow entrance sills are rare. Bottom irregularities may be responsible for internal waves, and the effect of the irregular plan form on circulation has yet to be evaluated.

30. Some Characteristics of Bute Inlet Sediments. By R. B. Toombs. Presented by H. C. Gunning, F.R.S.C.

A report is given of a laboratory analysis of Bute Inlet bottom samples. Mineralogical, fossil, physical, and chemical characteristics of the sediments are described. In addition to descriptive aspects of the sedimentary analysis, some attention is given to interpretative aspects; and the sediment properties are to a certain degree related to drainage basin geology in illustration of the role of laboratory analysis in the reading of sedimentary history.

31. Tidal Variations of Daily Mean Level. By N. O. Fothergill and R. C. DesLauriers. Presented by A. G. Huntsman, F.R.S.C.

A general discussion of the variation of mean level is followed by an example of a large fortnightly variation (MS_f) at Quebec. A suggested explanation, the river effect, is presented. This is followed by a discussion of long-period partial tides in the open ocean and a suggested gyral structure is developed and compared to observations. The deduced formulae are used to provide a rational explanation of current observations at Sambro Lightship. Finally a brief discussion of meteorological effects, and the possible existence of simple harmonics of the main long-period partial tides, is presented.

SECTION V. BIOLOGICAL SCIENCES

Monday, June 11

11.00 A.M.—Business Meeting of Section (Room H'804).
Opening of Arctic Exhibit.

2.00 P.M.—Meeting of Section (Room H'804). Papers 1–5.

1. Presidential Address: By Georges Maheux, F.R.S.C.

2. Flavelle Medallist's Address.

3. The Effects of Phospholipids and Venom Phospholipases on Mitochondrial Metabolism. By E. Petrushka, J. H. Quastel, F.R.S.C., and P. G. Scholefield.

The effects of aqueous extracts of heated venoms on the oxidative metabolism of pyruvate by rat-liver, -kidney and -brain mitochondria have been studied. These extracts, which are known to contain heat stable lecithinases, bring about an initial stimulation of the rate of oxygen consumption which is followed by a marked inhibition, and eventual cessation, of oxygen uptake.

The addition of purified egg yolk lecithin, commercial animal lecithin, or a crude beef-brain phospholipid mixture to mitochondrial suspensions may modify their respiratory activities. In addition, these substances may secure a considerable alleviation of the inhibitory action of the heated venom. These facts point to an intimate connection between phospholipids and mitochondrial respiratory activity.

4. Studies on Rhizosphere Bacteria. By H. Katznelson. Presented by A. G. Lochhead, F.R.S.C.

Recent studies have dealt with the relative growth of bacteria isolated from soil in the immediate vicinity of the roots of plants (rhizosphere) and from soil apart from these roots. Isolates from the rhizospheres of peas and barley and from control soil were compared on different media for amount of growth after a 5-day incubation period. The results show that a significantly larger number of bacteria from both rhisospheres grew more rapidly and more abundantly than isolates from control soil. The data suggest that the rhizosphere exerts a preferential effect on such actively multiplying soil bacteria.

5. Soil—an Important Habitat of Vitamin-requiring Bacteria. By A. G. Lochhead, F.R.S.C., and Margaret O. Burton.

The use of non-selective isolation procedures permitted estimations of the incidence in soil of organisms requiring specific vitamins for growth. For a relatively high proportion of the indigenous soil bacteria (27 per cent, corresponding to 14 millions per gram) one or more vitamins were essential. In all, 17 different "patterns" were noted for vitamin requirements. The results not only point to the soil as a source of bacteria of highly diversified vitamin needs, but underline the importance of including growth-factor effects in any consideration of the microbial economy of soil, particularly as affecting interrelationships between the normal soil microflora, plant disease organisms, and the plant itself.

Tuesday, June 12

9.30 A.M.—Inter-section Meeting (Room H'804).

Panel Discussion: Foreign Languages and the Progress of Literature and the Sciences. Pierre Dansereau, F.R.S.C., chairman. Discussants: Jean-Charles Falardeau, F.R.S.C. (Section I); H. Alexander, F.R.S.C. (Section II); C. P. Leblond, F.R.S.C. (Section V).

The panel will enquire into the following question: "How necessary is direct access to documents in other languages to various categories of intellectual workers, and what is the relative gravity of handicaps in this matter?"

After a brief statement by chairman and the panel members, general discussion will follow in which it is hoped that the differences between the disciplines (with respect to language requirement) will be emphasized as well as their common needs.

Mardi, 12 juin

9.30 A.M.—Séance conjointe (Salle H'804).

Forum: Les langues étrangères et le progrès de la littérature et des sciences. Pierre Dansereau, M.S.R.C., modérateur; Jean-Charles Falardeau, M.S.R.C. (Section I); H. Alexander, M.S.R.C. (Section II); C. P. Leblond, M.S.R.C. (Section V).

Les participants poseront la question suivante: "Jusqu'à quel point l'accès direct aux documents rédigés en langue étrangère est-il nécessaire aux travailleurs intellectuels de diverses catégories et quelle est la gravité relative d'un handicap en cette matière?"

A la suite d'une bref exposé du modérateur et des participants des diverses sections, une discussion générale s'engagera où l'on espère percevoir les différences entre les disciplines (en ce qui concerne les exigences de langage) aussi bien que leurs besoins communs.

2.00 P.M.—Meeting of Subsection Medical Sciences (Room H'702). Papers 6–10.

6. Influence of Ionic Strength and Phosphate Concentration on Tension Responses of Glycerol-extracted Muscle Fibres. By Dyson Rose and R. P. Newbold. Presented by N. E. Gibbons, F.R.S.C.

Tension developed by glycerol-extracted fibres of rabbit psoas in the presence of ATP is sensitive to changes in the inorganic composition of the surrounding medium. Tension decreased slightly with increasing ionic strength but this change was independent of added magnesium and was not reversed by calcium. A more marked decrease in tension was observed when orthophosphate concentration and ionic strength were both increased. Since this effect was dependent on the presence of added magnesium and was reversed by calcium, it appears to be a true relaxation.

7. Levels of Ribonucleases in Various Organs. By Gaston de Lamirande. Presented by Antonio Cantero, F.R.S.C.

The presence of acid and alkaline ribonuclease, which has been demonstrated in rat liver, has been investigated in other tissues. Activity of acid and alkaline ribonuclease has been

found in intestinal mucosa, spleen, liver, kidney, and mammary carcinoma of the mouse and of the rat. It has also been found in the thymus, brain, and heart of the rat. The level of enzyme activity varied to a great extent from one tissue to another.

8. Postoperative Modifications in the Electrophoretic Pattern of Serum Proteins. By Joseph Sternberg and Georges Préfontaine, F.R.S.C.

The electrophoretic pattern of serum proteins has been studied during a period of 30 days after intervention in 45 patients having had major lung operations. A significant and consistent increase of the alpha 2 and alpha 1 globulins was noted, together with an increase of the protein-bound polysaccharides. The sedimentation rate follows closely the above modifications.

This increase is mostly manifested towards the second week after operation, its maximum occurring between the 7th and 15th day. Thus, it does not seem to be directly linked to the postoperative shock which occurs much earlier after operation (6–48 hours).

It seems also that the "second week alpha globulinic crisis" is more specifically related to the lung operations, because in patients who have had a thyroidectomy (30 cases) the increase is far less significant and in other cases (nephrectomy) it is completely absent.

9. Etiological Factors in Congenital Clefts of the Lip and Palate. By F. Clarke Fraser. Presented by R. Darnley Gibbs, F.R.S.C.

Experiments in mice have demonstrated that congenital cleft palate can arise in several ways, each influenced by multiple genetic and environmental factors. The situation in humans resembles that in mice in that cleft palate alone seems etiologically different from cleft lip with or without cleft palate, and in that cleft palate is more likely to occur in offspring of light than of heavy mothers.

In humans, the risk of recurrence in siblings is estimated as between 3.4 and 5.7 per cent if the proband has a cleft lip (± cleft palate), and between 2.2 and 4.3 per cent if the proband has cleft palate alone.

10. Effect of Pitressin on Iodine Metabolism in Mice. By H. Isler and C. P. Leblond, F.R.S.C.

Sodium chloride induces a considerable loss of iodine into the urine, thus reducing the amount available to the thyroid gland. Addition of sodium chloride to a low iodine diet accentuates iodine deficiency and markedly enhances goitre production (work done in collaboration with A. Axelrad).

In a search for other factors capable of inducing a urinary loss of iodine, it was found that the posterior pituitary antidiuretic factor (pitressin) was highly effective and, therefore, might have a goitrogenic influence. Factors such as stress and emotion which induce a release of pitressin (Mirsky, Stein, and Paulisch, 1954) may thus increase the urinary loss of iodine. Such factors would facilitate the development of goitre in regions where the iodine intake is critical.

2.00 P.M.—Meeting of Subsection Biological Sciences (Room H'704). Papers 11–16.

11. The Distribution of Canadian Freshwater Amphipod Crustaceans. By E. L. Bousfield. Presented by A. G. Huntsman, F.R.S.C.

Eleven species of Amphipods have been recorded from freshwaters in Canada. In coastal streams of British Columbia occur *Anisogammarus ramellus* (Weckel), *Anisogammarus pacificus*, n.sp., and *Corophium spinicorne* Stimps. From the Pacific to the Atlantic are found *Gammarus lacustris* Sars in lakes, *Crangonyx occidentalis* H. & H. in bog ponds, *Hyalella azteca* (Sauss.) almost ubiquitous, and *Pontoporeia affinis* Lindstr. in deep lakes and northern estuaries. In eastern Canada are found *Crangonyx gracilis* Smith in temporary pools, rivers, and lakes, *Gammarus pseudolimnaeus* n.sp. in streams, *Gammarus fasciatus* Say in rivers, lakes, and estuaries, and *Gammarus duebeni* Lillj. in seaside streams and pools.

12. The Embryonic Development of the Alimentary Canal in Spiders. By J. G. Rempel. Presented by D. S. Rawson, F.R.S.C.

For nearly a century the development of spiders has been a favourite subject of the embryologists of invertebrates. Although the general trends in the embryology of the Arachnida are now well known, much controversy still centres around the origin of the mesenteron. Since, in spiders, the midgut develops into a large and complex structure, its embryonic origin is of special interest. A study of the embryology of the black-widow spider reveals that in this species the mesenteron is derived from vitellocytes. Such derivation was postulated by several workers at the turn of the century, but rejected by later workers.

13. The Differentiation Tendencies of Explants of Neural Ectoderm of the Chick Embryo at Various Stages in Development. By David J. McCallion. Presented by E. Horne Craigie, F.R.S.C.

One of the most fundamental and inescapable problems of experimental embryology is that of the origin and establishment of organization patterns in the nervous system and its substrate. For the chick, in the stages when ectoderm is being underlain by mesoderm, it has not been technically possible to separate the two layers for experimental purposes. The author in co-operation with P. D. Nieuwkoop of the Hubrecht Laboratory, Utrecht, Holland, and K. Hara of Nagoya University, Japan, has developed a procedure for separating these layers at the definitive primitive streak stage, head process stages, and later. This procedure will be described. The ectoderm, free of mesoderm, has been raised in nutrient synthetic media, as chorio-allantoic grafts or as intracoelomic grafts. The differentiation tendencies of these explants will be described and their significance discussed.

14. The Occurrence and Function of Trehalose in Ascaris Eggs. By Donald Fairbairn. Presented by T. W. M. Cameron, F.R.S.C.

Fertilized eggs of *Ascaris lumbricoides* at all stages of their development contain large (and nearly equal) amounts of glycogen and a non-reducing sugar which has been isolated and identified as the disaccharide, trehalose ((α-D-glucosido)-α-D-glucoside). Glycogen is confined to the embryonic tissues, whereas trehalose occurs almost exclusively in the perivitelline fluids. During development to the vermiform stage, both of these carbohydrates contribute significantly to the energy metabolism of the embryo, decreasing thus to about one-half their initial amounts, that is, from 7 to 3.5 per cent (dry weight). In the next stage of development, in which the vermiform embryo matures and becomes infective, trehalose and glycogen are resynthesized to their initial levels by processes which, on the basis of results obtained from experiments with C^{14} carbon dioxide, are identical. Thereafter, the surviving embryos do not metabolize significant amounts of carbohydrates. The concentration of trehalose in the perivitelline fluid of the infective egg is about 14 per cent (w/v). In addition to its more obvious rôle in energy metabolism, the possibility that trehalose is concerned in the mechanics of egg hatching will be considered.

15. A Rapid Cytophotometric Method for the Determination of Ploidy in Mammalian Cells. By Roger Mathieu. Presented by L. C. Simard, F.R.S.C.

In this method ploidy is calculated on the basis of desoxyribo-nucleic acid (DNA) content of individual nuclei. For the determination of DNA the Feulgen reaction is used. The measurements of relative optical density of individual isolated stained nuclei are made by means of a simplified cytophotometric technique. This method has the following advantages: (1) the nuclear DNA content can be measured irrespective of the lack of homogeneity of the nucleus and of its size and form; (2) the rapidity of the method makes possible a great number of determinations in a short period of time.

Precision of the method and experimental data on rat liver and kidney will be presented and discussed.

16. Exercise and Temperature Regulation in Small Mammals. By J. S. Hart. Presented by W. H. Cook, F.R.S.C.

Heat produced by exercise in mice, rats, lemmings, and rabbits has been found not to substitute for heat production resulting from exposure to cold. Cold thermogenesis was, within limits, independent of exercise and independent of colonic temperature change during exercise. These phenomena can be explained by assuming that temperature gradients controlling the thermogenesis are affected mainly by environmental temperature and only slightly or not at all by exercise. Experimental evidence on rats supports this viewpoint, which is incompatible with a dominant dependence of cold thermogenesis on central body temperature.

Wednesday, June 13

9.00 A.M.—Meeting of Subsection Medical Sciences (Room H'702). Papers 17–27.

17. Glucose-6-Phosphate Utilization Studies in Normal and Neoplastic Liver. By George Weber. Presented by L. C. Simard, F.R.S.C.

Glucose-6-phosphate utilization was compared in normal and neoplastic liver. For normal tissue, liver of rats (150–200 grams of weight) was taken. For neoplastic studies, the transplantable Novikoff hepatoma was used. The glucose-6-phosphate utilization was studied by examining the activity of the enzymes involved in the immediate utilization of glucose-6-phosphate as substrate. The activity of phosphoglucomutase, glucose-6-phosphatase, glucose-6-phosphate dehydrogenase and phosphohexoseisomerase was followed by spectrophotometric methods.

In comparison with normal liver, phosphoglucomutase and glucose-6-phosphatase were greatly decreased or absent, whereas glucose-6-phosphate dehydrogenase and phosphohexoseisomerase activities were highly increased in the hepatoma. Significance of these data will be discussed.

18. The Application of the Macrophage Exudate Technique (MET) for Experimental Transmission of Murine Leprosy from the Susceptible to the Non-susceptible Host. By Laszló Kátó et Béla Gözsy. Presented by A. Frappier, F.R.S.C.

According to Hanks and Gray, the infectiousness of transferred infecting material in murine leprosy is highly decreased by natural extracellular inhibitors. A technique was

devised in our laboratories for experimental transmission of rat leprosy, without exposing the parasite to the serious damage of the extracellular inhibitors. A macrophage exudate is induced in the peritoneal cavity of Wiersing rats and the granuloma homogenate is transferred into this favourable biosphere. The MET permits the transmission of the disease from one peritoneal exudate into the other. If the defence mechanism is suppressed by a synthetic antihistaminic substance, it is possible to transfer the rat leprosy into the peritoneal cavity of the non-susceptible host, the guinea-pig, after induced macrophage exudate. A traceless disappearance of rat leprosy bacilli is observed in the peritoneal cavity of the control animals. Experimental transmission by the MET and simultaneous antihistaminic treatment lead to the formation of granulomas in the non-susceptible host, followed by a histological appearance, typical of that of murine leprosy.

19. Purification de l'anatoxine diphtérique par l'emploi combiné du méthanol et du sulfate d'ammonium. Par J. de Repentigny. Présenté par A. Frappier, M.S.R.C.

Une méthode de purification de l'anatoxine diphtérique a été mise au point : elle permet d'obtenir un produit hautement purifié, susceptible de servir à l'immunisation des adultes. S'inspirant des travaux de Lepow et Pillemer, exécutés sur la toxine, les auteurs ont employé successivement diverses méthodes chimiques : précipitations par le méthanol et par le sulfate d'ammonium, et adsorption sur alumine. Cette méthode, relativement simple et reproductible, donne un produit ayant 1800–2100 Lf/mgN non dialysable; le rendement est 33–42 pour cent. La pureté du produit purifié a été étudiée au moyen d'analyses physico-chimiques.

20. The Relation of Stress to Haemorrhage and Prothrombin Time, following Anticoagulants. By L. B. Jaques, F.R.S.C., L. M. Fisher and G. J. Mogenson.

Previous studies in this laboratory have indicated that haemorrhage is rare in normal animals maintained on moderate doses of anticoagulants. In the present experiments, rabbits and rats maintained on dicumarol or phenylindanedione showed a 50 per cent mortality from haemorrhage when subjected to stress agents compared to a negligible mortality from anticoagulants or stress agents separately. It is suggested that stress may be the major precipitating factor in haemorrhage with anticoagulant therapy.

Rabbits subjected to stress showed higher values for the two-stage prothrombin time and slower recovery after anticoagulants. Stress agents caused an increase in the prothrombin time of many rats.

21. Aspect de gonflement spécifique de la capsule chez des Staphylocoques. Images obtenues au microscope électronique. Par Armand Frappier, M.S.R.C., et Sorin Sonea.

Avec les techniques courantes de laboratoire, les staphylocoques ne montrent pas de capsules à l'exception de quatre souches décrites comme exceptionnelles. Nous avons pu mettre en évidence à l'aide du microscope électronique, l'existence d'une formation capsulaire chez toutes les souches de Staphylocoque examinées. Ces bactéries, mises en présence de leur anti-sérum homologue, ont présenté au microscope électronique, un aspect de gonflement de capsule. Ces constatations présentent un intérêt tant du point de vue de la morphologie des Staphylocoques que du point de vue du conflit entre ces microorganismes et l'hôte infecté.

22. La Diffusion bactérienne comme critère de l'immunité antituberculeuse. I, Evaluation d'une méthode d'étude. Par M. Panisset et J. C. Benoît. Présenté par A. Frappier, M.S.R.C.

Les auteurs ont utilisé la souris comme animal d'expérience. La vaccination au BCG est pratiquée par voie intra-veineuse intrajugulaire après anesthésie. Ce premier travail décrit les diverses techniques qui ont dû être utilisées pour l'étude de la seule vaccination; à savoir les unités viables retrouvées dans la rate après 15 jours pour diverses doses de vaccin.

En vue d'apprécier des diffusions pauci-bacillaires, les auteurs ont modifié la méthode de numération de Juliue. Elle permet, en effet, l'ensemencement d'un échantillonnage important en utilisant un volume relativement minime de milieu de culture.

Cette analyse de la diffusion bacillaire dans la rate de la souris était la première phase d'une étude en cours sur les propriétés immunisantes de divers vaccins antituberculeux.

23. Tuberculosis and Thyroid Function. III. Tissular Distribution of Simultaneously Injected I^{131} and P^{32} in the BCG-Vaccinated Guinea-Pig. By J. Sternberg and A. Frappier, F.R.S.C.

It has been shown that BCG-immunized guinea-pigs have an increased uptake of radio-iodine in their tissues, especially in the adrenals. On the other hand, an acceleration of the P^{32} turnover has been noted in the BCG-immunized as well as in the tuberculous animals. Since the thyroid hormone is supposed to uncouple the oxidative phosphorylation in the mitochondrias of the target tissues, a correlation of the two above-mentioned findings might lead to a relationship between the mechanism of immunization in tuberculosis and the rate of utilization of thyroid hormones by the tissues of the vaccinated animals.

In order to study this problem, 100 microcuries of NaI^{131} and 100 microcuries of $P^{32}O_4Na_2H$ have been simultaneously injected into vaccinated and control animals and the respective content of each isotope assayed in various tissues. The P^{32} content of the ATP fractions was assayed in liver, spleen, adrenals, and muscle, and the respective ratios of the ATP^{32} and I^{131} were compared in the two groups of animals.

24. Micronuclear Components and Reproduction in Blood Cells. By V. E. Engelbert. Presented by J. R. Dymond, F.R.S.C.

The chromatin lumps within the nuclear membrane in lymphocytes are individual micronuclear structures and behave as micronuclei do in *Paramecium*.

Small lymphocytes will associate two and two in a process of conjugation and their "micronuclei" follow a behaviour pattern of pregamic divisions, synkaryon formation, and finally divisions of synkaryae that lead to anlagen of new cells.

25. Cathepsin: An Improved Method of Assay and its Intracellular Distribution in Rat Liver. By Claude Allard. Presented by Antonio Cantero, F.R.S.C.

A simple and accurate method of assay of cathepsin activity in rat liver homogenate is presented.

The procedure is as follows. In a total volume of 3 ml. the reaction mixture contains at a final concentration: haemoglobin, 0.00039M.; acetate buffer, 0.17M pH 3.6; and the tissue suspension. After 30 minutes' incubation at 37° C., the reaction is stopped with 5 ml. TCA 5 per cent, the acid-soluble material is collected and appropriately diluted and its optical

density read at 275 λ in U.V. spectrophotometer. The activity is expressed as micromoles of tyrosine liberated per minute per 100 mg. of tissue.

Application of this method to the study of the intracellular distribution of cathepsin activity in rat liver cells will be discussed.

26. The Effect of Heat on Rat Liver Ribonucleases. By Jean Zytko and Gaston de Lamirande. Presented by Antonio Cantero, F.R.S.C.

Previous results suggested the presence of two ribonucleases in rat liver. To differentiate further these enzymes, the effect of heat was investigated. Heating of rat liver homogenates and isolated mitochondrial preparations for 3 to 5 minutes destroyed 90 to 95 per cent of the original acid ribonuclease activity whereas a loss of only 40 to 50 per cent was observed in the activity of the alkaline enzyme. It would thus seem that the acid and alkaline ribonucleases of rat liver are two different enzymes.

27. On the Role of the Adrenal Cortex in the Production of Renal Calcification. By Hans Selye, F.R.S.C., and Pierre Bois.

In rats sensitized by unilateral nephrectomy and 2 mg. of desoxycorticosterone acetate (DOCA) per day, the administration of 1.2 per cent NaH_2PO_4 as a drinking fluid produces marked renal calcifications within ten days. No such calcifications are seen in controls similarly treated but not given DOCA, nor in those receiving cortisol acetate (COLA) instead of DOCA. Indeed, the ability of DOCA to sensitize for such renal calcifications is largely counteracted by concurrent COLA-treatment. Histologic studies (Kossa's stain) show the calcium deposits to be predominantly localized in Henle's loops.

9.00 A.M.—Meeting of Subsection Biological Sciences (Room H'704). Papers 28–37.

28. The Physiology of *Xanthomonas phaseoli* and *X. phaseoli* var. *sojensis* in relation to their Pathogenicity. By Roy L. Millar. Presented by F. L. Drayton, F.R.S.C.

The pathogen-suscept relationships of *Xanthomonas phaseoli* (E. F. Sm.) Dowson and *X. phaseoli* var. *sojensis* (Hedges) Starr and Burk. were investigated primarily on the bases of: (1) antibiotic phenomena, and (2) physiology of the organisms in relation to their pathogenicity. No evidence was obtained to indicate that the restricted pathogenicity of the two pathogens might be explained on the basis of specific antibiotics present in the plant tissues. The results of studies employing supplemented and non-supplemented basal media suggest that the pH of the plant tissues should be considered in any approach to an understanding of a pathogen-suscept relationship.

29. New Data on the Relation of the Root Habit with the Crown Deterioration of White Birch. By René Pomerleau, F.R.S.C., and Marcel Lortie.

Differences in white birch decline according to sites have been previously noted and reported. Studies carried out in 1948 and again in 1953 and 1954 in most regions of Quebec, have indicated a direct relationship between the depth of rooting and the degree of crown deterioration. In 1955, a more detailed investigation of the rooting habit of 34 trees from

one locality, with the trenching method, has again shown that shallow-rooted trees are more severely affected than those having deeper growing subterranean parts. At the same time, a study of the complete root system of 4 trees by soil excavation and root washing provided better data in confirmation of this trend.

30. Algal Indicators of Trophic Lake Types. By D. S. Rawson, F.R.S.C.

The dominant species of algae in the Great Lakes and in the large oligotrophic lakes of western Canada are not those commonly quoted as oligotrophic indicators. It is suggested that this apparent discrepancy may be due to the lack of sufficiently detailed taxonomic information, to the non-existence of oligotrophic indicators, or to the fact that oligotrophy of these lakes is essentially morphometric rather than edaphic. The utility of phytoplankton quotients and the problem of numbers of species versus dominant species are discussed.

31. Studies of the Annual Cycle of Phytoplankton Production in the Arctic Ocean. By A. Bursa. Presented by M. J. Dunbar, F.R.S.C.

The ecology of the phytoplankton of the open water belt of the Arctic Ocean off the Alaskan Coast was studied by means of the sedimentation quantitative method. Five different interlocking cycles of phytoplankton were distinguished, corresponding to the different ecological niches: (1) the life cycle under the ice; (2) the "open leads" cycle in neritic and pelagic areas; (3) the microflora upon melting ice close to the coast; (4) the microflora on the ice extending from the permanent ice edge northwards; and (5) the phytoplankton cycle of the open waters. Neritic elements prevail in inshore waters during calm weather, pelagic species after strong northern winds. Easterly currents influence the ecological composition of plankton and its concentration on the Alaskan Coast. The main limiting factor for plankton growth is ice-cover, which retards metabolism for nine to eleven months of the year.

32. The Application of Cultural Methods to Problems in Taxonomy and Evolution in the Hymenomycetes. By Mildred K. Nobles. Presented by J. Walton Groves, F.R.S.C.

Cultural studies in Hymenomycetes have revealed a correlation between certain characters considered to indicate progress in evolutionary development. Species with nodose-septate hyphae and utilizing cellulose only are bipolar whereas those producing oxidase and thus utilizing lignin are tetrapolar. Species with simple-septate hyphae in the advancing zone and nodose-septate hyphae elsewhere are bipolar but also form oxidase. Homothallic species with simple-septate hyphae or with occasional multiple clamp connections are interpreted as reduced from ancestral heterothallic forms. Relationships indicated by these groupings cut across conventional morphological classifications.

33. Sur l'existence d'un centre quiescent au niveau du méristème de la racine de *Pinus banksiana* Lamb. Par Lévi Chouinard. Présenté par Georges Maheux, M.S.R.C.

Au moyen de la chambre claire, nous avons relevé, sur des coupes axiales du méristème de cinquante racines, les cellules en voie de division. En superposant les dessins obtenus, nous avons pu étudier la répartition statistique des mitoses au niveau de ce même méristème.

Les résultats montrent l'absence à peu près complète de mitoses dans la région apicale

axiale du méristème. Ce centre quiescent a la forme d'une demi-lune dont la base repose sur les cellules proximales de la coiffe. Les cellules initiales, à rôle histogénétique, seraient situées sur le pourtour de ce massif cellulaire mitotiquement inactif.

La signification physiologique de ce centre quiescent reste inconnue, mais il se peut qu'il joue un rôle important dans la croissance et la différenciation de la racine.

34. Antiquity of Form in Canadian Plant microfossils. By Norman W. Radforth and Colin McGregor. Presented by H. B. Sifton, F.R.S.C.

A survey of large numbers of plant microfossils occurring in Palaeozoic rocks reveals the early presence of form entities that persist through time, though species apparently fluctuate in prominence. The extent to which this occurs is assessed in relation to geological time scale (with emphasis on the Palaeozoic). Biological trends are suggested and correlated with age.

35. Floral Transgression of Major Geological Time Zones. By Norman W. Radforth and Glenn E. Rouse. Presented by H. B. Sifton, F.R.S.C.

Species occurrence and distribution have, until recently, been determined mainly by inspection of macrofossil conspecti which are held to be representative of associated geological time intervals. Recent discoveries of widely dispersed assemblages of fossil spores and pollens within sedimentary strata have suggested revision of the theoretical conclusions which have been based solely on macrofossil evidence.

Within selected horizons of the Palaeozoic and the Mesozoic eras, microfossil evidence for the existence of floras is often present where macrofossil records are lacking. By reason of inherent physical characters, microfossils exhibit greater potentialities for widespread distribution within sedimentary strata then do co-existent macrofossils. On the basis of this and other factors, evidence now exists which indicates that ecological and stratigraphical shifts occurred within certain geological horizons in Canada, and that the history of occurrences of plant forms transcends geological revolutions to a greater extent than has been previously appreciated.

36. The Phytogeographical Importance of *Frullania Bolanderi*. By James Kucyniak. Presented by Marcel Raymond, F.R.S.C.

The hepatic *Frullania Bolanderi* Aust. was first described from California in 1869 and, for almost half a century, was known to occur only on the west coast. In 1914, it was reported from northern Wisconsin, and, a year later, from eastern Quebec (Bic). Its subsequent discovery in the Keweenaw Peninsula led W. C. Steere to identify this species with the group of disrupted western elements in the bryophyte flora of that phytogeographically important area. From stations recently reported by R. M. Schuster, Ernest Lepage, and the author, a further evaluation of the phytogeographical significance of this hepatic may be drawn.

37. Affinités géographiques des Cypéracées de l'Afghanistan. Par Marcel Raymond, M.S.R.C.

La famille est peu développée, mais elle offre un matériel phytogéographique d'un grand intérêt, qui éclaire les origines de la flore afghane générale. On y rencontre des éléments subtropicaux-cosmopolites, méditerranéens, eurasiatiques, asiatiques, arctiques-alpins,

alpins-polycentriques (comme le *Scirpus pumilus*). Les 6 *Cobresia* et les 25 *Carex* indiquent surtout des affinités avec l'Asie Mineure, l'Asie Moyenne, l'Asie Centrale, le Tibet et l'Himalaya. Le Nuristan, à l'extrême est, subit l'influence de la mousson. Les endémiques sont d'affinités iraniennes, tibétaines ou pamiriennes.

2.00 P.M.—Section Meeting (Room H'804). Papers 38–42.

38. The Occurrence of Trace Elements in Maritime Algae. By E. Gordon Young, F.R.S.C., and W. M. Langille.

Specimens of typical species of green, red, and brown algae have been analysed for arsenic, calcium, cobalt, copper, fluorine, iodine, manganese, molybdenum, nickel, potassium, silicon, sodium, and zinc, both for the intrinsic concentration and the seasonal variation. Marked differences are apparent between species and classes, probably indicative of both physiological requirements and habitat.

39. The Relationship between Ethylene Evolution and Fruit Respiration. By Mary S. Spencer. Presented by H. Bruce Collier, F.R.S.C.

It is known that ethylene is evolved by ripening fruits and that its administration to green fruit hastens ripening. Ethylene evolution was shown to be closely related to respiration by the following: the increase in respiration when tomatoes were ripened in an atmosphere of oxygen rather than air was accompanied by a proportional increase in ethylene evolution. The effect of 2,4-dinitrophenol (which uncouples respiration from phosphorylation) on respiration and ethylene evolution was investigated and will be discussed with respect to the development of natural uncoupling agents in ripening fruits.

40. Blood Levels of Lactic Acid in Yearling Sockeye Salmon, *Oncorhyncus nerka*, Exercised in Freshwater and Seawater. By Edgar C. Black. Presented by A. H. Hutchinson, F.R.S.C.

The average blood levels of lactic acid for the unexercised condition at 8–12° C. was found to be 17 ± 2 ($\pm$ standard error) mg. per cent in freshwater and 24 ± 3 mg. per cent in salmon exposed to seawater for two days. Following vigorous exercise for 15 minutes the respective averages were: in freshwater, 112 ± 5 mg. per cent; in seawater, 167 ± 9 mg. per cent. After recovery for two hours in the respective media, the averages were: in freshwater, 211 ± 15 mg. per cent; in seawater, 117 ± 31 mg. per cent. From these data it would appear that seawater is beneficial in removing lactic acid from the blood of salmon recovering from muscular fatigue.

41. The Role of Manganese in the Inactivation of the Plant Hormone, Indoleacetic Acid. By E. R. Waygood and G. A. Maclachlan. Presented by R. Darnley Gibbs, F.R.S.C.

The decarboxylation and oxidation of indoleacetic acid can be catalysed either by manganic ions in complex with ethylenediamenetetracetate or by manganic ions generated by a plant phenol-peroxidase system. Evidence will be presented supporting the hypothesis that the mangano-manganic equilibrium plays a role in the destruction of indoleacetic acid *in vivo* and hence in the growth processes of plants.

42. Rôle déterminant du manganèse dans la succession *Pinus banksiana* Lamb.—*Picea mariana* (Mills) BSP. Par André Lafond. Présenté par Georges Maheux, M.S.R.C.

Les recherches poursuivies jusqu'ici par l'auteur tendent a prouver que le manganèse joue un rôle de premier plan dans la reproduction du pin gris. La régénération de cette essence semble être conditionnée par une concentration en manganèse soluble d'environ 10 p.p.m. dans l'humus. D'autre part, l'épinette noire s'accommode de concentrations en manganèse soluble de l'ordre de 200 p.p.m.; ce qui explique que l'épinette est mieux adaptée au manganèse et que, dans ces conditions, elle puisse succéder au pin gris.

PRINTED IN CANADA
THE UNIVERSITY OF TORONTO PRESS